Analytic integration of real-virtual counterterms in NNLO jet cross sections I

Aglietti, U ; Del Duca, V ; Duhr, C ; Somogyi, G ; Trócsányi, Z

Abstract: We present analytic evaluations of some integrals needed to give explicitly the integrated real-virtual counterterms, based on a recently proposed subtraction scheme for next-to-next-to-leading order (NNLO) jet cross sections. After an algebraic reduction of the integrals, integration-by-parts identities are used for the reduction to master integrals and for the computation of the master integrals themselves by means of differential equations. The results are written in terms of one- and two-dimensional harmonic polylogarithms, once an extension of the standard basis is made. We expect that the techniques described here will be useful in computing other integrals emerging in calculations in perturbative quantum field theories.

DOI: https://doi.org/10.1088/1126-6708/2008/09/107

Originally published at:
Aglietti, U; Del Duca, V; Duhr, C; Somogyi, G; Trócsányi, Z (2008). Analytic integration of real-virtual counterterms in NNLO jet cross sections I. Journal of High Energy Physics, (9):107.
DOI: https://doi.org/10.1088/1126-6708/2008/09/107

Preprint typeset in JHEP style - HYPER VERSION

arXiv:yymm.nnnn [hep-ph]
CP3-08-21
ZU-TH 10/08

Analytic integration of real-virtual counterterms in NNLO jet cross sections I

Ugo Aglietti
Dipartimento di Fisica, Università di Roma "La Sapienza", and INFN, Sezione di Roma, Italy
E-mail: Ugo.Aglietti@roma1.infn.it

Vittorio Del Duca*
INFN, Laboratori Nazionali di Frascati, Via E. Fermi 40, I-00044Frascati, Italy
E-mail: Vittorio.DelDuca@lnf.infn.it

Claude Duhr
Institut de Physique Théorique and Centre for Particle Physics and Phenomenology (CP3) Université Catholique de Louvain Chemin du Cyclotron 2, B-1348 Louvain-la-Neuve, Belgium
E-mail: claude.duhr@uclouvain.be

Gábor Somogyi
Institute for Theoretical Physics, University of Zürich Winterthurerstrasse 190, CH-8057 Zürich, Switzerland
E-mail: sgabi@physik.unizh.ch

Zoltán Trócsányi
University of Debrecen and Institute of Nuclear Research of the Hungarian Academy of Sciences, H-4001 Debrecen P.O.Box 51, Hungary
E-mail: Zoltan.Trocsanyi@cern.ch

Abstract: We present analytic evaluations of some integrals needed to give explicitly the integrated real-virtual integrated counterterms, based on a recently proposed subtraction scheme for next-to-next-to-leading order (NNLO) jet cross sections. After an algebraic reduction of the integrals, integration-by-parts identities are used for the reduction to master integrals and for the computation of the master integrals themselves by means of differential equations. The results are written in terms of one- and two-dimensional harmonic polylogarithms, once an extension of the standard basis is made. We expect that the techniques described here will be useful in computing other integrals emerging in calculations in perturbative quantum field theories.

Keywords: QCD, Jets.

*On leave of absence from INFN, Sezione di Torino.

Contents

1. Introduction

LHC physics demands calculating physical observables beyond leading order (LO) accuracy, by including the virtual and real corrections that appear at higher orders. However, the evaluation of phase space integrals beyond LO is not straightforward because it involves infrared singularities that have to be consistently treated before any numerical computation may be performed. At next-to-leading order (NLO), infrared divergences can be handled using a *subtraction scheme* exploiting the fact that the structure of the kinematical singularities of QCD matrix elements is universal and independent of the hard process. This allows us to build process-independent counterterms which regularize the one-loop (or virtual) corrections and real phase space integrals simultaneously [1].

In recent years a lot of effort has been devoted to the extension of the subtraction method to the computation of the radiative corrections at the next-to-next-to-leading order (NNLO) [2–11]. In particular, in Ref. [12,13], a subtraction scheme was defined for computing NNLO corrections to QCD jet cross sections to processes without coloured partons in the initial state and an arbitrary number of massless particles (coloured or colourless) in the final state. This scheme however is of practical utility only after the universal counterterms for the regularization of the real emissions are integrated over the phase space of the unresolved particles. The integrated counterterms can be computed once and for all and their knowledge is necessary to regularize the infrared divergences appearing in virtual corrections. That is indeed the task of this work: we analytically evaluate some of the integrals needed for giving explicitly the counterterms appearing in the scheme [12, 13]. The method is an adaptation of a technique developed in the last two decades to compute multi-loop Feynman diagrams [14–19]. To our knowledge this is the first time that these techniques are applied to integrals of the type

$$F(z) \;=\; \int_0^1 \int_0^{\alpha_0} \mathrm{d}x\,\mathrm{d}y\, x^{k_1\epsilon}\,(1-x)^{k_2\epsilon}\,y^{k_3\epsilon}\,(1-y)^{k_4\epsilon}\,(1-xyz)^{k_5\epsilon}\,f(x,y,z)\,, \tag{1.1}$$

where

$$f(x,y,z) \;=\; \frac{1}{x^{n_1}}\,\frac{1}{(1-x)^{n_2}}\,\frac{1}{y^{n_3}}\,\frac{1}{(1-y)^{n_4}}\,\frac{1}{(1-xyz)^{n_5}}\,, \tag{1.2}$$

with n_i being non-negative integers and $0 < \alpha_0 \leq 1$.

An alternative method for computing the ϵ-expansion of the integrals is iterated sector decomposition. This approach allows one to express the expansion coefficients of all functions we consider as finite, multidimensional integrals. Integrating these representations numerically, we obtain the expansion coefficients for any fixed value of the arguments. Every integral in this paper was computed numerically as well, with this alternative method for selected values of the parameters. We found that in all cases the analytical and numerical results agreed up to the uncertainty associated with the numerical integration.

The outline of the paper is the following. In Sect. 2 we outline the steps of our method. In Sect. 3 we define the integrals of the subtraction terms that we will consider in the paper. Our analytic results will be presented in terms of one- and two-dimensional harmonic polylogarithms. We summarize those properties of these functions that are important for our computations in Sects. 4 and 5, respectively. In Sects. 6 and 7 we calculate analytically the integrals needed for integrating the soft-type counterterms as a series expansion in the dimensional regularization parameter ϵ. In Sect. 8 we calculate some of the integrlas needed for integrating the collinear counterterms. In Sects. 9 and 10 we calculate two sets of convoluted integrated counterterms, which can be obtained from a successive integration of the results obtained in Sect. 8. Sect. 11 briefly discusses the numerical calculation of the integrated subtraction terms and the merits of both the analytical and the numerical approaches. Finally in Sect. 12 we present the conclusions of this work and we discuss possible developments concerning more complicated classes of integrals. Appendix A contains the spin-averaged splitting function at tree level and at one-loop, which are needed for the evaluation of the counterterms. There are further appendices containing the (often rather lengthy) expressions of the integrated counterterms.

2. The method

Our method of computing the integrals involves the following steps:

Algebraic reduction of the integrand by means of partial fractioning. For each class of integrals, we perform a partial fractioning of the integrand in order to obtain a set of independent integrals. For example, for the integrand in Eq. (1.2) with $n_1 = n_2 = n_3 = n_4 = n_5 = 1$ one can perform partial fractioning with respect to the integration variable x first, so that

$$\frac{1}{x\,(1-x)\,(1-xyz)} = \frac{1}{x} + \frac{1}{1-yz}\,\frac{1}{1-x} - \frac{y^2z^2}{1-yz}\,\frac{1}{1-xyz}\,. \tag{2.1}$$

Note the appearance of the new denominator $1 - yz$, not originally present in the integrand and coming from x partial fractioning[1]. One then performs partial fractioning with respect to y, by considering the denominator $1-xyz$ as a constant: that is because the latter was already involved in the x partial fractioning and, to avoid an infinite loop, it cannot be subjected to any further transformation. For example:

$$\begin{aligned}\frac{1}{y\,(1-y)\,(1-yz)\,(1-xyz)} &= -\frac{z^2}{1-z}\,\frac{1}{(1-yz)\,(1-xyz)} + \frac{1}{y\,(1-xyz)} + \\ &\quad + \frac{1}{1-z}\,\frac{1}{(1-y)\,(1-xyz)}\,. \end{aligned} \tag{2.2}$$

After this final partial fractioning over y, the original integrand f, depending on five denominators, is transformed into a combination of terms having at most two denominators, out of which at most one depends on x.[2]

Reduction to master integrals by means of integration-by-parts identities. We then write integration-by-parts identities (ibps) for the chosen set of independent amplitudes. If the upper limits in the x or y integrals in Eq. (1.1) differ from one, $\alpha_0 < 1$, surface terms have to be taken into account. That is to be contrasted with the case of loop calculations, in which surface terms always vanish. By solving the ibps with the standard Laporta algorithm, complete reduction to master integrals is accomplished.

Analytic evaluation of the Master Integrals. After having identified for each class of integrals a set of master integrals, we write the corresponding system of differential equations. The ϵ-expansion of the master integrals is obtained by solving such systems expanded in powers of ϵ. A natural basis consists of one- and two-dimensional harmonic polylogarithms [20, 21]; for representing some master integrals, an extension of the standard basis functions has proved to be necessary.

3. Integrals needed for the integrated subtraction terms

The subtraction method developed in Refs. [12, 13] relies on the universal soft and collinear factorization properties of QCD squared matrix elements. Although the necessary factorization

[1]By increasing the number of variables, the number of additional denominators grows very fast.

[2]Performing first the partial fractioning in y and then in x results in a different basis of independent amplitudes.

formulae for NNLO computations have been known for almost a decade, the explicit definition of a subtraction scheme has been hampered for several reasons. Firstly, the various factorization formulae overlap in a rather complicated way beyond NLO accuracy and these overlaps have to be disentangled in order to avoid multiple subtractions. At NNLO accuracy this was first achieved in Ref. [11]. A general and simple solution to this problem was subsequently given in Ref. [22], where a method was described to obtain pure-soft factorization at any order in perturbation theory leading to soft-singular factors without collinear singularities.

Secondly, the factorization formulae are valid only in the strict soft and collinear limits and have to be extended to the whole phase space. A method that works at any order in perturbation theory requires a mapping of the original n momenta $\{p\}_n = \{p_1, \dots, p_n\}$ to m momenta $\{\tilde{p}\}_m = \{\tilde{p}_1, \dots, \tilde{p}_m\}$ (m is the number of hard partons and $n-m$ is the number of unresolved ones) that preserves momentum conservation. Such a mapping leads to an exact factorization of the original n-particle phase space of total momentum Q,

$$\mathrm{d}\phi_n(p_1, \dots, p_n; Q) = \prod_{i=1}^{n} \frac{\mathrm{d}^d p_i}{(2\pi)^{d-1}}\, \delta_+(p_i^2)\, (2\pi)^d \delta^{(d)}\left(Q - \sum_{i=1}^{n} p_i\right), \tag{3.1}$$

in the form

$$\mathrm{d}\phi_n(\{p\}_n; Q) = \mathrm{d}\phi_m(\{\tilde{p}\}_m; Q)\, [\mathrm{d}p_{n-m;m}(\{p\}_{n-m}; Q)]\,. \tag{3.2}$$

In the context of computing QCD corrections, this sort of exact phase-space factorization was first introduced in Ref. [1], where only three of the original momenta $\{p\}$ – that of the emitter p_i^μ, the spectator p_k^μ and the emitted particle p_j^μ – were mapped to two momenta, $\tilde{p}_{ij}^\mu$ and $\tilde{p}_k^\mu$, the rest of the phase space was left unchanged. This sort of mapping requires that both i and k be hard partons, which is always satisfied in a computation at NLO accuracy because only one parton is unresolved. However, in a computation beyond NLO the spectator momentum may also become unresolved unless this is explicitly avoided by using colour-ordered subamplitudes [7, 8]. In order to take into account the colour degrees of freedom explicitly, as well as define a phase space mapping valid at any order in perturbation theory, in Ref. [23], two types of 'democratic' phase-space mappings were introduced. In this paper we are concerned with the integrals of the singly-unresolved counterterms, therefore, in the rest of the paper we deal with the case when $m = 1$. Symbolically, the mapping

$$\{p\}_n \xrightarrow{\mathrm{C}_{ir}} \{\tilde{p}\}_{n-1}^{(ir)} = \{\tilde{p}_1, \dots, \tilde{p}_{ir}, \dots, \tilde{p}_n\}\,, \tag{3.3}$$

used for collinear subtractions, denotes a mapping where the momenta p_i^μ and p_r^μ are replaced by a single momentum $\tilde{p}_{ir}^\mu$ and all other momenta are rescaled, while for soft-type subtractions,

$$\{p\}_n \xrightarrow{\mathrm{S}_r} \{\tilde{p}\}_{n-1}^{(r)} = \{\tilde{p}_1, \dots, \tilde{p}_n\} \tag{3.4}$$

denotes a mapping such that the momentum p_r^μ, that may become soft, is missing from the set, and all other momenta are rescaled and transformed by a proper Lorentz transformation. These mappings are defined such that the recoil due to the emission of the unresolved partons is taken by all hard partons. In both cases the factorized phase-space measure can be written in the form of a convolution.

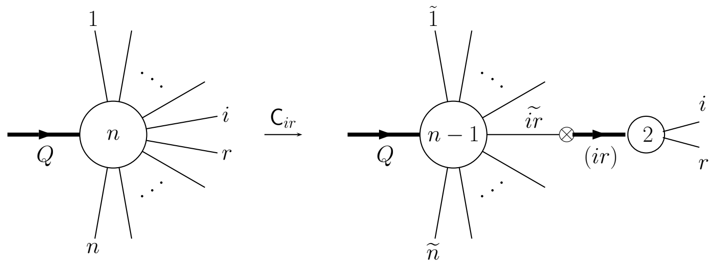

Figure 1: Graphical representation of the collinear momentum mapping and the implied phase space factorization.

3.1 Definition of the collinear integrals

In the case of collinear mapping the factorized phase-space measure can be written as

$$[\mathrm{d}p_{1;n-1}^{(ir)}(p_r,\tilde{p}_{ir};Q)] = \int_0^1 \mathrm{d}\alpha\,(1-\alpha)^{2(n-2)(1-\epsilon)-1}\,\frac{s_{\widetilde{ir}Q}}{2\pi}\,\mathrm{d}\phi_2(p_i,p_r;p_{(ir)})\,, \tag{3.5}$$

where $s_{\widetilde{ir}Q} = 2\tilde{p}_{ir}\cdot Q$ and $p_{(ir)}^{\mu} = (1-\alpha)\tilde{p}_{ir}^{\mu} + \alpha Q^{\mu}$. The collinear momentum mapping and the implied factorization of the phase-space measure are represented graphically in Fig. 1. The picture on the left shows the n-particle phase space $\mathrm{d}\phi_n(\{p\};Q)$, where in the circle we have indicated the number of momenta. The picture on the right corresponds to Eq. (3.2) (with $m=1$) and Eq. (3.5): the two circles represent the $(n-1)$-particle phase space $\mathrm{d}\phi_{n-1}(\{\tilde{p}\}^{(ir)};Q)$ and the two-particle phase space $\mathrm{d}\phi_2(p_i,p_r;p_{(ir)})$ respectively, while the symbol $\otimes$ stands for the convolution over α, as precisely defined in Eq. (3.5).

Writing the factorized phase space in the form of Eq. (3.5) has some advantages:

- It makes the symmetry property of the factorized phase space under the permutation of the factorized momenta manifest. For instance, for any function f,

$$\int [\mathrm{d}p_{1;n-1}^{(ir)}(p_r,\tilde{p}_{ir};Q)]\,f(p_i,p_r) = \int [\mathrm{d}p_{1;n-1}^{(ir)}(p_r,\tilde{p}_{ir};Q)]\,f(p_r,p_i)\,, \tag{3.6}$$

  which can be used to reduce the number of independent integrals.
- It exhibits the n-dependence of the factorized phase space explicitly. This allows for including n-dependent factors of $(1-\alpha)^{2d_0-2(n-2)(1-\epsilon)}\Theta(\alpha_0-\alpha)$ (with $d_0\big|_{\epsilon=0} \ge 2$) in the subtraction terms such that the integrated counterterms will be n-independent (for details see Ref. [24]).
- Eq. (3.5) generalizes very straightforwardly for more complicated factorizations. (The formula for the general case when phase-spaces of N groups of $r_1, r_2, \ldots, r_N$ partons are factorized simultaneously can be given explicitly.)

To write the factorized two-particle phase-space measure we introduce the variable v,

$$v = \frac{z_r - z_r^{(-)}}{z_r^{(+)} - z_r^{(-)}}\,. \tag{3.7}$$

In Eq. (3.7) z_r is the momentum fraction of parton r in the Altarelli–Parisi splitting function that describes the $f_{(ir)} \to f_i + f_r$ collinear splittings (f denotes the flavour of the partons). This momentum fraction takes values between

$$z_r^{(-)} = \frac{\alpha}{2\alpha + x - \alpha x} \tag{3.8}$$

and $z_r^{(+)} = 1 - z_r^{(-)}$ ($x = s_{\widetilde{ir}Q}/Q^2$). Using the variables $s_{ir} = 2p_i \cdot p_r$, and v the two-particle phase-space measure reads

$$\begin{aligned} \mathrm{d}\phi_2(p_i, p_r; p_{(ir)}) &= \frac{s_{ir}^{-\epsilon}}{8\pi} S_\epsilon \, \mathrm{d}s_{ir} \, \mathrm{d}v \, \delta\big(s_{ir} - Q^2\alpha\big(\alpha + (1-\alpha)x\big)\big) \\ &\times [v\,(1-v)]^{-\epsilon} \, \Theta(1-v)\Theta(v) \,, \end{aligned} \tag{3.9}$$

where

$$S_\epsilon = \frac{(4\pi)^\epsilon}{\Gamma(1-\epsilon)} \,. \tag{3.10}$$

The integration of the collinear subtractions over the unresolved phase space involves the integrals [24]

$$\frac{(4\pi)^2}{S_\epsilon}(Q^2)^{(1+\kappa)\epsilon} \int_0^{\alpha_0} \mathrm{d}\alpha\,(1-\alpha)^{2d_0-1} \frac{s_{\widetilde{ir}Q}}{2\pi} \mathrm{d}\phi_2(p_i, p_r; p_{(ir)}) \frac{1}{s_{ir}^{1+\kappa\epsilon}} P^{(\kappa)}_{f_i f_r}(z_i, z_r; \epsilon) \,, \qquad \kappa = 0,\, 1 \,, \tag{3.11}$$

where $\alpha_0 \in (0, 1]$ while $P^{(0)}_{f_i f_r}$ and $P^{(1)}_{f_i f_r}$ denote the average of the tree-level and one-loop splitting kernels over the spin states of the parent parton (Altarelli–Parisi splitting functions), respectively. These spin-averaged splitting kernels depend, in general, on z_i and z_r, with the constraint

$$z_i + z_r = 1 \,, \tag{3.12}$$

and are listed in Appendix A. Inspecting the actual form of the Altarelli–Parisi splitting functions and using the symmetry property of the factorized phase space under the interchange $i \leftrightarrow r$, we find that (3.11) can be expressed as a linear combination of the integrals

$$\frac{(4\pi)^2}{S_\epsilon}(Q^2)^{(1+\kappa)\epsilon} \int_0^{\alpha_0} \mathrm{d}\alpha_{ir}\,(1-\alpha_{ir})^{2d_0-1} \, \frac{s_{\widetilde{ir}Q}}{2\pi} \int \mathrm{d}\phi_2(p_i, p_r; p_{(ir)}) \, \frac{z_r^{k+\delta\epsilon}}{s_{ir}^{1+\kappa\epsilon}} \, g_I^{(\pm)}(z_r) \,, \tag{3.13}$$

for $k = -1, 0, 1, 2$, $\kappa = 0, 1$ and the values of δ and functions $g_I^{(\pm)}$ as given in Table 1.

Using Eqs. (3.7)–(3.9) and z_r expressed with v,

$$z_r = \frac{\alpha + (1-\alpha)xv}{2\alpha + (1-\alpha)x} \,, \tag{3.14}$$

we can see that the integrals in Eq. (3.13) take the form

$$\begin{aligned} \mathcal{I}(x; \epsilon, \alpha_0, d_0; \kappa, k, \delta, g_I^{(\pm)}) &= x \int_0^{\alpha_0} \mathrm{d}\alpha \, \alpha^{-1-(1+\kappa)\epsilon} \, (1-\alpha)^{2d_0-1} \, [\alpha + (1-\alpha)x]^{-1-(1+\kappa)\epsilon} \\ \times \int_0^1 \mathrm{d}v [v\,(1-v)]^{-\epsilon} & \left(\frac{\alpha + (1-\alpha)xv}{2\alpha + (1-\alpha)x} \right)^{k+\delta\epsilon} \, g_I^{(\pm)} \left(\frac{\alpha + (1-\alpha)xv}{2\alpha + (1-\alpha)x} \right) \,. \end{aligned} \tag{3.15}$$

We compute the integrals corresponding to the first two rows of Table 1 in Sect. 8.

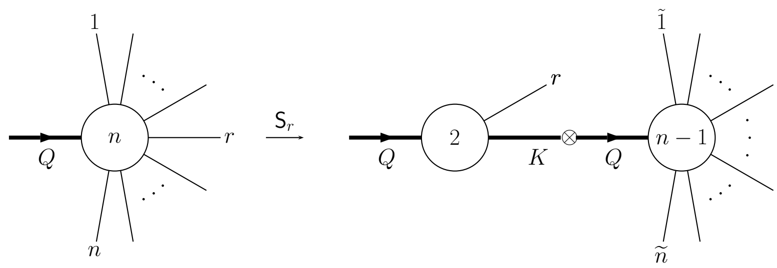

Figure 2: Graphical representation of the soft momentum mapping and the implied phase space factorization.

3.2 Definition of the soft-type integrals

In the case of soft mapping the factorized phase-space measure can be written as

$$[\mathrm{d}p_{1;n-1}^{(r)}(p_r;Q)] = \int_0^1 \mathrm{d}y(1-y)^{(n-2)(1-\epsilon)-1}\frac{Q^2}{2\pi}\mathrm{d}\phi_2(p_r,K;Q) \tag{3.16}$$

δ	Function	$g_I^{(\pm)}(z)$
0	g_A	1
∓ 1	$g_B^{(\pm)}$	$(1-z)^{\pm\epsilon}$
0	$g_C^{(\pm)}$	$(1-z)^{\pm\epsilon}{}_2F_1(\pm\epsilon,\pm\epsilon,1\pm\epsilon,z)$
± 1	$g_D^{(\pm)}$	${}_2F_1(\pm\epsilon,\pm\epsilon,1\pm\epsilon,1-z)$

Table 1: The values of δ and $g_I^{(\pm)}(z_r)$ at which Eq. (3.13) needs to be evaluated.

where the timelike momentum K is massive with $K^2 = (1-y)Q^2$. We show the soft momentum mapping and the implied phase space factorization in Fig. 2. The picture on the left shows again the n-particle phase space $\mathrm{d}\phi_n(\{p\};Q)$, while the picture on the right corresponds to Eq. (3.2) (with $m = 1$) and Eq. (3.16): the two circles represent the two-particle phase space $\mathrm{d}\phi_2(p_r,K;Q)$ and the $(n-1)$-particle phase space $\mathrm{d}\phi_{n-1}(\{\tilde{p}\}^{(r)};Q)$ respectively. The symbol $\otimes$ stands for the convolution over y as defined in Eq. (3.16).

The soft and soft-collinear subtraction terms involve the integral of the eikonal factor and its collinear limit over the factorized phase space of Eq. (3.16) [24], namely the integrals

$$-\frac{(4\pi)^2}{S_\epsilon}(Q^2)^{(1+\kappa)\epsilon}\int_0^{y_0}\mathrm{d}y\,(1-y)^{d_0'-1}\frac{Q^2}{2\pi}\mathrm{d}\phi_2(p_r,K;Q)\left(\frac{s_{ik}}{s_{ir}s_{kr}}\right)^{1+\kappa\epsilon}, \qquad \kappa = 0,1\,, \tag{3.17}$$

$$\frac{(4\pi)^2}{S_\epsilon}(Q^2)^{(1+\kappa)\epsilon}\int_0^{y_0}\mathrm{d}y\,(1-y)^{d_0'-1}\frac{Q^2}{2\pi}\mathrm{d}\phi_2(p_r,K;Q)2\left(\frac{1}{s_{ir}}\frac{z_i}{z_r}\right)^{1+\kappa\epsilon}, \qquad \kappa = 0,1\,. \tag{3.18}$$

Here again, we included harmless factors of $(1-y)^{d_0'-(n-2)(1-\epsilon)}\Theta(y_0-y)$ (with $d_0'|_{\epsilon=0} \geq 2$) in the subtraction terms to make their integrals independent of n. The computation of these integrals is fairly straightforward using energy and angle variables.

In order to write the factorized phase-space measure, we choose a frame in which

$$Q^\mu = \sqrt{s}(1,\ldots)\,, \qquad \tilde{p}_i^\mu = \tilde{E}_i(1,\ldots,1)\,, \qquad \tilde{p}_k^\mu = \tilde{E}_k(1,\ldots,\sin\chi,\cos\chi)\,, \tag{3.19}$$

and

$$p_r^\mu = E_r(1, ..\text{‘angles’}.., \sin\vartheta\sin\varphi, \sin\vartheta\cos\varphi, \cos\vartheta)\,. \tag{3.20}$$

In Eq. (3.19) the dots stand for vanishing components, while the notation ‘angles’ in Eq. (3.20) denotes the dependence of p_r on the $d-3$ angular variables that can be trivially integrated. Then in terms of the scaled energy-like variable

$$\varepsilon_r = \frac{2p_r\cdot Q}{Q^2} = \frac{2E_r}{\sqrt{s}} \tag{3.21}$$

and the angular variables ϑ and φ the two-particle phase space reads

$$\begin{aligned} \mathrm{d}\phi_2(p_r, K; Q) = \frac{(Q^2)^{-\epsilon}}{16\pi^2} S_\epsilon \frac{\Gamma^2(1-\epsilon)}{\Gamma(1-2\epsilon)}\, \mathrm{d}\varepsilon_r\, \varepsilon_r^{1-2\epsilon}\delta(y-\varepsilon_r) \\ \times \mathrm{d}(\cos\vartheta)\,\mathrm{d}(\cos\varphi)(\sin\vartheta)^{-2\epsilon}(\sin\varphi)^{-1-2\epsilon}\,, \end{aligned} \tag{3.22}$$

where $y \in (0,1]$ and the cosines of both angles run from -1 to $+1$.

To write the integrands in these variables, we observe that the precise definitions of $\tilde{p}_i$ and $\tilde{p}_k$ as given in Ref. [12] imply

$$s_{ik} = (1-\varepsilon_r)s_{\tilde{i}\tilde{k}}\,, \qquad s_{ir} = s_{\tilde{i}r}\,, \qquad s_{kr} = s_{\tilde{k}r}\,, \tag{3.23}$$

and

$$s_{iQ} = (1-\varepsilon_r)s_{\tilde{i}Q} + s_{\tilde{i}r}\,. \tag{3.24}$$

From Eqs. (3.19), (3.20), (3.23) and (3.24) we find

$$\frac{s_{ik}}{s_{ir}s_{kr}} = (1-\varepsilon_r)\frac{s_{\tilde{i}\tilde{k}}}{s_{\tilde{i}r}s_{\tilde{k}r}} = \frac{4Y_{\tilde{i}\tilde{k},Q}}{Q^2}\frac{(1-\varepsilon_r)}{\varepsilon_r^2}\frac{1}{(1-\cos\vartheta)(1-\cos\chi\cos\vartheta-\sin\chi\sin\vartheta\cos\varphi)}\,, \tag{3.25}$$

and

$$\frac{1}{s_{ir}}\frac{z_i}{z_r} = \frac{1}{s_{\tilde{i}r}}\frac{(1-\varepsilon_r)s_{\tilde{i}Q}+s_{\tilde{i}r}}{s_{rQ}} = \frac{1}{Q^2}\frac{1}{\varepsilon_r}\left[1+\frac{2(1-\varepsilon_r)}{\varepsilon_r(1-\cos\vartheta)}\right]\,. \tag{3.26}$$

Using Eqs. (3.22), (3.25) and (3.26) we see that the integral of the soft subtraction term in Eq. (3.17) may be written as

$$\begin{aligned} \mathcal{J}(Y_{\tilde{i}\tilde{k},Q}; \epsilon, y_0, d_0'; \kappa) = -(4Y_{\tilde{i}\tilde{k},Q})^{1+\kappa\epsilon}\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\Omega^{(1+\kappa\epsilon,1+\kappa\epsilon)}(\cos\chi) \\ \times \int_0^{y_0}\mathrm{d}y\, y^{-1-2(1+\kappa)\epsilon}(1-y)^{d_0'+\kappa\epsilon}\,, \end{aligned} \tag{3.27}$$

where $\Omega^{(i,k)}(\cos\chi)$ denotes the angular integral

$$\begin{aligned} \Omega^{(i,k)}(\cos\chi) = \int_{-1}^{1}\mathrm{d}(\cos\vartheta)\ (\sin\vartheta)^{-2\epsilon}\int_{-1}^{1}\mathrm{d}(\cos\varphi)\ (\sin\varphi)^{-1-2\epsilon} \\ \times (1-\cos\vartheta)^{-i}(1-\cos\chi\cos\vartheta-\sin\chi\sin\vartheta\cos\varphi)^{-k}\,. \end{aligned} \tag{3.28}$$

Furthermore, from Eq. (3.19) it is easy to see that

$$\cos\chi = 1 - 2\,Y_{\tilde{i}\tilde{k},Q} \equiv 1 - \frac{2Q^2 s_{\tilde{i}\tilde{k}}}{s_{\tilde{i}Q}s_{\tilde{k}Q}}\,. \tag{3.29}$$

We compute the soft integrals $\mathcal{J}(X,\epsilon;y_0,d_0';\kappa)$ in Sect. 6.

The soft-collinear subtraction term in Eq. (3.18) leads to the integral

$$\begin{aligned}\mathcal{K}(\epsilon,y_0,d_0';\kappa) =\; & 2\int_0^{y_0} \mathrm{d}y\, y^{-(2+\kappa)\epsilon}(1-y)^{d_0'-1}\int_{-1}^{1}\mathrm{d}(\cos\vartheta)\,(\sin\vartheta)^{-2\epsilon} \\ & \times\left[1+\frac{2(1-y)}{y(1-\cos\vartheta)}\right]^{1+\kappa\epsilon}\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\int_{-1}^{1}\mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon}\,,\end{aligned} \tag{3.30}$$

which we compute in Sect. 7.

3.3 Iterated integrals

In an NNLO computation, iterations of the above integrals also appear. In this paper we compute also two of those. The first one is the integration of a soft integral with a collinear one in its argument,

$$\begin{aligned}\mathcal{J}{*}\mathcal{I}(Y_{\tilde{i}\tilde{k},Q};\epsilon,\alpha_0,d_0,y_0,d_0';k) =& -4Y_{\tilde{i}\tilde{k},Q}\,\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\,\Omega^{(1,1)}(\cos\chi) \\ & \times\int_0^{y_0}\mathrm{d}y\, y^{-1-2\epsilon}(1-y)^{d_0'}\,\mathcal{I}(y;\epsilon,\alpha_0,d_0;0,k,0,1)\,,\end{aligned} \tag{3.31}$$

which we need for $k=-1,0,1,2$. Details of the computation are given in Sect. 9. The second case is when the collinear integral appears in the argument of a soft-collinear one,

$$\begin{aligned}\mathcal{K}{*}\mathcal{I}(\epsilon,\alpha_0,d_0,y_0,d_0';k) =\; & 2\,\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\int_{-1}^{1}\mathrm{d}(\cos\vartheta)\,(\sin\vartheta)^{-2\epsilon} \\ & \times\int_{-1}^{1}\mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon}\int_0^{y_0}\mathrm{d}y\, y^{-1-2\epsilon}\,(1-y)^{d_0'-1} \\ & \times\frac{2-y(1+\cos\vartheta)}{1-\cos\vartheta}\,\mathcal{I}(y;\epsilon,\alpha_0,d_0;0,k,0,1)\,,\end{aligned} \tag{3.32}$$

needed again for $k=-1,0,1,2$. Details of the computation are given in Sect. 10.

4. One-dimensional harmonic polylogarithms

As anticipated in the introduction, it is convenient to represent the integrals depending on a single variable x in terms of a general class of special functions called harmonic polylogarithms (*HPL's*) introduced in Ref. [20]. The *HPL's* of weight one, i.e. depending on one index $w=-1,0,1$, are defined as:

$$H(-1;x)\equiv\log(1+x)\,;\quad H(0;x)\equiv\log(x)\,;\quad H(1;x)\equiv-\log(1-x)\,. \tag{4.1}$$

These functions are then just logarithms of linear functions of x. The *HPL's* of higher weight are defined recursively by the relation

$$H(a,\vec{w};x)\equiv\int_0^x f(a;x')\,H(\vec{w};x')\,\mathrm{d}x'\quad\text{for } a\neq0 \text{ and } \vec{w}\neq\vec{0}_n\,, \tag{4.2}$$

i.e. in the case in which not all the indices are zero. The left-most index takes the values $a = -1, 0, 1$ and $\vec{w}$ is an $n-$dimensional vector with components $w_i = -1, 0, 1$. We call n the weight of the *HPL's* , so the above relation allows one to increase the weight $w = n \to n+1$. The basis functions $f(a; x)$ are given by

$$f(-1; x) \equiv \frac{1}{1+x}; \quad f(0; x) \equiv \frac{1}{x}; \quad f(1; x) \equiv \frac{1}{1-x}. \tag{4.3}$$

In the case in which all indices are zero, one defines instead,

$$H(\vec{0}_n; x) \equiv \frac{1}{n!} \log^n(x). \tag{4.4}$$

The *HPL's* introduced above fulfill many interesting relations, one of the most important ones being that of generating a 'shuffle algebra',

$$H(\vec{w}_1; x)\, H(\vec{w}_2; x) = \sum_{\vec{w}=\vec{w}_1 \uplus \vec{w}_2} H(\vec{w}; x), \tag{4.5}$$

where $\vec{w}_1 \uplus \vec{w}_2$ denotes the merging of the two weight vectors $\vec{w}_1$ and $\vec{w}_2$, *i.e.* all possible concatenations of $\vec{w}_1$ and $\vec{w}_2$ in which relative orderings of $\vec{w}_1$ and $\vec{w}_2$ are preserved.

The basis of *HPL's* can be extended by adding some new basis functions to the set in Eq. (4.3); for our computation we have to introduce the function

$$f(2; x) \equiv \frac{1}{x-2}. \tag{4.6}$$

The *HPL's* can be evaluated numerically in a fast and accurate way; there are various packages available for this purpose [25–27].

5. Two-dimensional harmonic polylogarithms

To represent integrals depending on two arguments, an extension of the *HPL's* to functions of two variables proves to be convenient [21]. Since a harmonic polylogarithm is basically a repeated integration on *one* variable, a second independent variable is introduced as a parameter entering the basis functions: $f(i; x) \to f(i, \alpha; x)$. We may say that in addition to the discrete index i, we have now a continuous index α. In Ref. [21] the following basis functions were originally introduced:

$$f(c_i(\alpha); x) = \frac{1}{x - c_i(\alpha)}, \tag{5.1}$$

where

$$c_1(\alpha) = 1 - \alpha \quad \text{or} \quad c_2(\alpha) = -\alpha. \tag{5.2}$$

Let us remark that the above extension keeps most of the properties of the one-dimensional *HPL's*. In this work we have to introduce the following new basis functions, which are slightly more complicated than the ones above,

$$f(c_1(\alpha); x) = \frac{1}{x - c_1(\alpha)} \quad f(c_2(\alpha); x) = \frac{1}{x - c_2(\alpha)}, \tag{5.3}$$

with

$$c_1(\alpha) \;=\; \frac{\alpha}{\alpha-1}\,, \qquad c_2(\alpha) \;=\; \frac{2\alpha}{\alpha-1}\,. \tag{5.4}$$

The explicit definition of the two-dimensional harmonic polylogarithms (*2dHPL's*) reads:

$$H(c_i(\alpha),\vec{w}(\alpha);x) \;\equiv\; \int_0^x f(c_i(\alpha);x')\,H(\vec{w}(\alpha);x')\,\mathrm{d}x'\,. \tag{5.5}$$

In general, the *2dHPL's* have complicated analyticity properties, with imaginary parts coming from integrating over the zeroes of the basis functions. Our computation does not involve such complications because we can always assume $0 \le x\,,\alpha \le 1$. That implies that $c_k(\alpha) < 0$ for any k: the denominators are never singular and the *2dHPL's* are real. The numerical evaluation of our *2dHPL's* can be achieved by extending the algorithm described and implemented in Ref. [28].

5.1 Special values

For some special values of the argument, the *2dHPL's* reduce to ordinary one-dimensional *HPL's*. It is easy to see that for $\alpha = 0$ and $\alpha = 1$ we have

$$f(c_k(\alpha=0);x) \;=\; f(0;x), \quad \lim_{\alpha\to 1} f(c_k(\alpha);x) = 0. \tag{5.6}$$

From this it follows that

$$\begin{aligned} &H(\ldots,c_i(\alpha=0),\ldots;x) = H(\ldots,0,\ldots;x),\\ &\lim_{\alpha\to 1} H(\ldots,c_i(\alpha),\ldots;x) = 0. \end{aligned} \tag{5.7}$$

Similarly, for $x = 1$, the *2dHPL's* reduce to combinations of one-dimensional *HPL's* in α. This reduction can be performed using an extension of the algorithm presented in [21]. We first write the *2dHPL's* in $x = 1$ as the integral of the derivative with respect to α,

$$H(\vec{w}(\alpha);1) = H(\vec{w}(\alpha=1);1) + \int_1^\alpha \mathrm{d}\alpha' \,\frac{\partial}{\partial\alpha'}\,H(\vec{w}(\alpha');1). \tag{5.8}$$

In the case where $\vec{w}$ only contains objects of the type c_i, we have $H(\vec{w}(\alpha=1);x) = 0$. Thus,

$$H(\vec{w}(\alpha);1) = \int_1^\alpha \mathrm{d}\alpha' \,\frac{\partial}{\partial\alpha'}\,H(\vec{w}(\alpha');1). \tag{5.9}$$

The derivative is then carried out on the integral representation of $H(\vec{w}(\alpha');1)$, and integrating back gives the desired reduction of $H(\vec{w}(\alpha);1)$ to one-dimensional *HPL's* in α, *e.g.*

$$\begin{aligned} &H(c_1(\alpha);1) = -\,H(0;\alpha)\,,\\ &H(c_2(\alpha);1) = H(-1;\alpha) - H(0;\alpha) - \ln 2. \end{aligned} \tag{5.10}$$

5.2 Interchange of arguments

The basis of *2dHPL's* introduced above selects x as the explicit (integration) variable and α as a parameter, but an alternative representation involving a repeated integration over α of (different) basis functions depending on x as an external parameter is also possible. Therefore, we have to deal with the typical problem of analytic computations: multiple representations of the same function. It is well known that a complete analytic control requires the absence of ‘hidden zeroes’ in the formulae. That means that one has to know all the transformation properties (identities) of the functions introduced in order to have a single representative out of each class of identical objects. In Ref. [21] an algorithm was presented which allows one to interchange the roles of the two variables. The algorithm is basically the same as the one presented for the special values at $x = 1$: let us just replace everywhere $x = 1$ by x in Eq. (5.9). Then we have to introduce the following set of basis functions for the *2dHPL’s* ,

$$f(d_k(x);\alpha) \;=\; \frac{1}{\alpha + d_k(x)}\,, \tag{5.11}$$

where

$$d_k(x) \;=\; \frac{x}{x-k}\,. \tag{5.12}$$

All the properties defined at the beginning of this section can be easily extended to this new class of denominators. One finds for example:

$$\begin{aligned} H(c_1(\alpha);x) &= H(0;x) \;-\; H(0;\alpha) \;+\; H(d_1(x);\alpha)\,, \\ H(c_2(\alpha);x) &= H(0;x) \;-\; H(0;\alpha) \;-\; \ln 2 \;+\; H(d_2(x);\alpha)\,. \end{aligned} \tag{5.13}$$

6. The soft integral $\mathcal{J}$

In this section we present the analytic calculation of the soft integral defined in Eq. (3.27) for $\kappa = 0, 1$ and $d_0' = D_0' + d_0'\epsilon$, with $D_0' \geq 2$ being an integer. The angular integral $\Omega^{(i,k)}(\cos\chi)$ was evaluated in Ref. [29]. The integration over y leads to a hypergeometric function, and for the complete soft integral (3.27) we obtain the analytic expression

$$\begin{aligned} \mathcal{J}(Y,\epsilon;y_0,d_0';\kappa) = -Y^{-(1+\kappa)\epsilon}\, y_0^{-2(1+\kappa)\epsilon}\, &\frac{1}{(1+\kappa)^2\epsilon^2}\frac{\Gamma^2(1-(1+\kappa)\epsilon)}{\Gamma(1-2(1+\kappa)\epsilon)} \\ &\times {}_2F_1(-d_0'-\kappa\epsilon, -2(1+\kappa)\epsilon, 1-2(1+\kappa)\epsilon, y_0) \\ &\times {}_2F_1(-(1+\kappa)\epsilon, -(1+\kappa)\epsilon, 1-\epsilon, 1-Y)\,, \end{aligned} \tag{6.1}$$

i.e. , we only need to find the ϵ-expansion of an integral of the form

$$f(x,\epsilon;n_1,n_2,n_3,r_1,r_2,r_3) = \int_0^1 \mathrm{d}t\, t^{-n_1-r_1\epsilon}\,(1-t)^{-n_2-r_2\epsilon}\,(1-xt)^{-n_3-r_3\epsilon}. \tag{6.2}$$

which can be obtained using the HypExp *Mathematica* package [30]. Nevertheless, we compute the expansion to show our procedure. The first hypergeometric function on the right hand side of Eq. (6.1) is of the specific form ${}_2F_1(a, b, 1 + b; x)$, whose expansion reduces to the expansion of the incomplete beta function B_x, which is a simple case to illustrate the steps of our procedure. It involves the integrals

$$\begin{aligned} \beta(x,\epsilon;n_1,n_3,r_1,r_3) = f(x,\epsilon;n_1,0,n_3,r_1,0,r_3) &= \int_0^1 \mathrm{d}t\, t^{-n_1-r_1\epsilon}\,(1-xt)^{-n_3-r_3\epsilon} \\ &= x^{-1+n_1+r_1\epsilon}\, B_x(1-n_1-r_1\epsilon, 1-n_3-r_3\epsilon). \end{aligned} \tag{6.3}$$

The class of independent integrals can be easily obtained using partial fractioning in x. However, when writing down the integration-by-parts identities for the independent integrals, we have to take into account a surface term coming from the fact that the denominator in $(1-xt')$ does not vanish for $t'=1$,

$$\int_0^1 \mathrm{d}t' \, \frac{\partial}{\partial t'} \left(t'^{-n_1-r_1\epsilon} \, (1-xt')^{-n_3-r_3\epsilon} \right) = (1-x)^{-n_3-r_3\epsilon}. \tag{6.4}$$

Solving the inhomogeneous linear system we find a single master integral

$$\beta^{(1)}(x,\epsilon) = \beta(x,\epsilon;0,0,r_1,r_3), \tag{6.5}$$

which fulfills the differential equation

$$\frac{\partial}{\partial x}\beta^{(1)} = \frac{r_1\epsilon - 1}{x}\,\beta^{(1)} + \frac{(1-x)^{-r_3\epsilon}}{x}\,, \tag{6.6}$$

with initial condition

$$\beta^{(1)}(x=0;\epsilon) = \int_0^1 \mathrm{d}t' \, t'^{-r_1\epsilon} = \frac{1}{1-r_1\epsilon} = \sum_{k=0}^{\infty} r_1^k \epsilon^k\,. \tag{6.7}$$

Solving this differential equation, we obtain the expansion of the incomplete beta function in terms of *HPL's* and thus the expansion of hypergeometric functions of the form ${}_2F_1(a,b,1+b;x)$.

Turning to the general case, we note that if we want to calculate the integral (6.2) using the integration-by-parts identities, we must require $r_1 \cdot r_2 \cdot r_3 \neq 0$, because the integration-by-parts identities can exhibit poles in $r_i = 0$. It is also useful to notice that not all of the integrals are independent, but only those where just one of the indices n_1, n_2, n_3 is nonzero and where $n_2, n_3 \geq 0$. In fact, all other integrals can be reduced to one of this class using partial fractioning, *e.g.*

$$f(x,\epsilon;1,-1,1,r_1,r_2,r_3) = f(x,\epsilon;1,0,0,r_1,r_2,r_3) - (1-x) f(x,\epsilon;0,0,1,r_1,r_2,r_3)\,. \tag{6.8}$$

If $r_1 \cdot r_2 \cdot r_3 \neq 0$, we can write immediately the integration-by-parts identities for the independent integrals for f obtained by partial fractioning,

$$\int_0^1 \mathrm{d}t \, \frac{\partial}{\partial t} \left(t^{-n_1-r_1\epsilon} \, (1-t)^{-n_2-r_2\epsilon} \, (1-xt)^{-n_3-r_3\epsilon} \right) = 0. \tag{6.9}$$

Solving the integration-by-parts identities we find that f has two master integrals,

$$f^{(1)}(x,\epsilon) = f(x,\epsilon;0,0,0,r_1,r_2,r_3), \quad f^{(2)}(x,\epsilon) = f(x,\epsilon;0,0,1,r_1,r_2,r_3). \tag{6.10}$$

The master integrals fulfill the following differential equations

$$\begin{aligned}
\frac{\partial}{\partial x} f^{(1)} &= \frac{\epsilon r_3}{x} f^{(2)} - \frac{\epsilon r_3}{x} f^{(1)}, \\
\frac{\partial}{\partial x} f^{(2)} &= f^{(1)} \left(\frac{-\epsilon r_1 - \epsilon r_2 - \epsilon r_3 + 1}{x} + \frac{\epsilon r_1 + \ \epsilon r_2 + \epsilon r_3 - 1}{x-1} \right) + \\
& \quad f^{(2)} \left(\frac{-\epsilon r_2 - \epsilon \ r_3}{x-1} + \frac{\epsilon r_1 + \epsilon r_2 + \epsilon r_3 - 1}{x} \right),
\end{aligned} \tag{6.11}$$

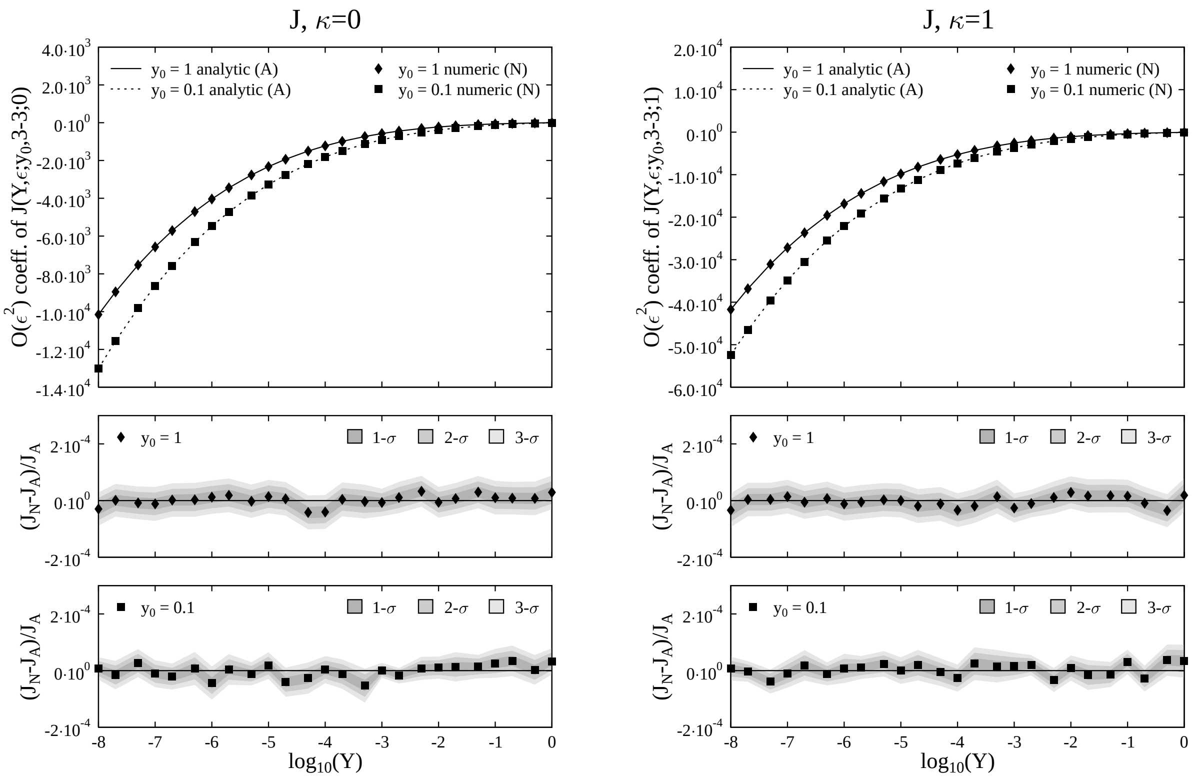

Figure 3: Representative results for the $\mathcal{J}$ integral. The plots show the coefficient of the $\mathrm{O}(\epsilon^2)$ term in $\mathcal{J}(Y,\epsilon;y_0,3-3\epsilon;\kappa)$ for $\kappa=0$ (left figure) and $\kappa=1$ (right figure) with $y_0=0.1,1$.

with initial condition

$$f^{(1)}(x=0,\epsilon)=f^{(2)}(x=0,\epsilon)=B(1-r_1\epsilon,1-r_2\epsilon). \tag{6.12}$$

Solving this set of linear differential equations we can write down the ϵ-expansion of the hypergeometric function in terms of *HPL's* in x.

The solution for the integral $\mathcal{J}$ can be easily obtained by using the expansion of the hypergeometric function we just obtained. The results for $\kappa=0,1$ and $D_0'=3$ can be found in Appendix B.

As representative examples, in Fig. 3 we compare the analytic and numeric results for the ϵ^2 coefficient in the expansion of $\mathcal{J}(Y,\epsilon;y_0,3-3\epsilon;\kappa)$ for $\kappa=0,1$ and $y_0=0.1,1$. The agreement between the two computations is seen to be excellent for the whole Y-range. We find a similar agreement for other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters.

7. The soft-collinear integral $\mathcal{K}$

In this section we calculate analytically the soft-collinear integral defined in Eq. (3.30) for $\kappa=0,1$ and $d_0'=D_0'+d_1'\epsilon$, D_0' being an integer. The φ integral is trivial to perform and we find

$$\frac{\Gamma^2(1-\epsilon)}{2\pi\Gamma(1-2\epsilon)}\int_{-1}^{1}\mathrm{d}(\cos\varphi)\,(\sin\varphi)^{-1-2\epsilon}=2^{-1+2\epsilon}. \tag{7.1}$$

Putting $\cos\vartheta = 2\xi - 1$, we are left with the integral

$$\mathcal{K}(\epsilon; y_0, d_0'; \kappa) = 2\int_0^{y_0} \mathrm{d}y \int_0^1 \mathrm{d}\xi\; y^{-1-2(1+\kappa)\epsilon}(1-y)^{d_0'-1}\xi^{-\epsilon}(1-\xi)^{-1-(1+\kappa)\epsilon}(1-y\xi)^{1+\kappa\epsilon}. \quad (7.2)$$

7.1 Analytic result for $\kappa = 0$

For $\kappa = 0$, the integral decouples into a product of two one-dimensional integrals and we get

$$\mathcal{K}(\epsilon; y_0, d_0'; 0) = 2\, B_{y_0}(-2\epsilon, d_0')\, B(1-\epsilon, -\epsilon) - 2\, B_{y_0}(1-2\epsilon, d_0')\, B(2-\epsilon, -\epsilon), \quad (7.3)$$

Using the expansion of the incomplete B-function, carried out in Sect. 6, we can immediately write down the expansion of $\mathcal{K}$ for $\kappa = 0$. The result for $D_0' = 3$ can be found in Appendix C.

7.2 Analytic result for $\kappa = 1$

The integral (3.30) for $\kappa = 1$ reads

$$\mathcal{K}(\epsilon; y_0, d_0'; 1) = 2\int_0^{y_0} \mathrm{d}y \int_0^1 \mathrm{d}\xi\; y^{-1-4\epsilon}(1-y)^{d_0'-1}\xi^{-\epsilon}(1-\xi)^{-1-2\epsilon}(1-y\xi)^{1+\epsilon}. \quad (7.4)$$

The analytic solution for this integral cannot be obtained in a straightforward way, due to the presence of the factor $(1-y\xi)^{\epsilon}$ that couples the two integrals. Therefore, we rewrite the integral in the form

$$\mathcal{K}(\epsilon; y_0, d_0'; 1) = 2\, y_0^{-4\epsilon}\, K(\epsilon; y_0, d_1'; 1, 1 - D_0', 0, 1, -1), \quad (7.5)$$

where

$$\begin{aligned} &K(\epsilon; y_0, d_1'; n_1, n_2, n_3, n_4, n_5) \\ &\quad = \int_0^1 \mathrm{d}y \int_0^1 \mathrm{d}\xi\; y^{-n_1-4\epsilon}(1-y_0 y)^{-n_2-d_1'\epsilon}\xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0 y\xi)^{-n_5+\epsilon}. \end{aligned} \quad (7.6)$$

We now calculate the integral K using the Laporta algorithm. The independent integrals can be obtained by partial fractioning in y and ξ, using the prescription that denominators depending on both integration variables are only partial fractioned in ξ, *e.g.*

$$\begin{aligned} \frac{1}{\xi(1-y_0 y\xi)} &\to \frac{1}{\xi} + \frac{y_0 y}{1-y_0 y\xi}, \\ \frac{1}{y(1-y_0 y\xi)} &\to \frac{1}{y(1-y_0 y\xi)}. \end{aligned} \quad (7.7)$$

When writing down the integration-by-parts identities for the independent integrals, we have to take into account a surface term coming from the fact that the denominator in $(1-y_0 y)$ does not vanish in $y = 1$,

$$\begin{aligned} &\int_0^1 \mathrm{d}y \int_0^1 \mathrm{d}\xi\, \frac{\partial}{\partial\xi}\left(y^{-n_1-4\epsilon}(1-y_0 y)^{-n_2-d_1'\epsilon}\xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0 y\xi)^{-n_5+\epsilon}\right) \\ &\quad = 0 \\ &\int_0^1 \mathrm{d}y \int_0^1 \mathrm{d}\xi\, \frac{\partial}{\partial y}\left(y^{-n_1-4\epsilon}(1-y_0 y)^{-n_2-d_1'\epsilon}\xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0 y\xi)^{-n_5+\epsilon}\right) \\ &\quad = (1-y_0)^{-n_3-d_1'\epsilon}\, K_S(\epsilon; y_0, d_1'; n_3, n_4, n_5), \end{aligned} \quad (7.8)$$

with

$$K_S(\epsilon; y_0, d_1'; n_3, n_4, n_5) = \int_0^1 \mathrm{d}\xi\, \xi^{-n_3-\epsilon}(1-\xi)^{-n_4-2\epsilon}(1-y_0\xi)^{-n_5+\epsilon}. \tag{7.9}$$

K_S is just a hypergeometric function,

$$\begin{aligned} &K_S(\epsilon; y_0, d_1'; n_3, n_4, n_5) \\ &\qquad = B(1-n_3-\epsilon, 1-n_4-\epsilon)\, {}_2F_1(1-n_3-\epsilon, n_5-2\epsilon, 2-n_2-n_4-3\epsilon; y_0), \end{aligned} \tag{7.10}$$

and can thus be calculated using the technique presented in Sect. 6.

Knowing the series expansion for the surface term K_S, we can solve the integration-by-parts identities for the K integrals, Eq. (7.8). We find the following two master integrals,

$$\begin{aligned} K^{(1)}(\epsilon; y_0, d_1') &= K(\epsilon; y_0, d_1'; 0, 0, 0, 0, 0), \\ K^{(2)}(\epsilon; y_0, d_1') &= K(\epsilon; y_0, d_1'; -1, 0, 0, 0, 0), \end{aligned} \tag{7.11}$$

fulfilling the following differential equations,

$$\begin{aligned} \frac{\partial}{\partial y_0} K^{(1)} &= \frac{4\epsilon - 1}{y_0}\, K^{(1)} + \frac{(1-y_0)^{d_1\epsilon}}{y_0}\, f^{(1)}, \\ \frac{\partial}{\partial y_0} K^{(2)} &= 2\,\frac{2\epsilon - 1}{y_0}\, K^{(2)} + \frac{(1-y_0)^{d_1\epsilon}}{y_0}\, f^{(1)}, \end{aligned} \tag{7.12}$$

where $f^{(1)}$ denotes the master integral of the hypergeometric function calculated in Sect. 6 and where the initial conditions are given by

$$\begin{aligned} K^{(1)}(\epsilon; y_0 = 0, d_1') &= B(1-4\epsilon, 1)\, B(1-\epsilon, 1-2\epsilon), \\ K^{(2)}(\epsilon; y_0 = 0, d_1') &= B(2-4\epsilon, 1)\, B(1-\epsilon, 1-2\epsilon). \end{aligned} \tag{7.13}$$

Plugging in the series expansion of $f^{(1)}$, and expanding $(1-y_0)^{d_1'\epsilon}$ into a power series in ϵ, we can solve for the $K^{(1)}$ and $K^{(2)}$ as a power series in ϵ whose coefficients are written in terms of *HPL's* in y_0.

Knowing the series expansions of $K^{(1)}$ and $K^{(2)}$, we can obtain the integral $\mathcal{K}(\epsilon; y_0, d_0'; 1)$ for any fixed integer D_0'. In Appendix C we give the explicit result for $D_0' = 3$.

8. The collinear integrals $\mathcal{I}$

In this section, we calculate the collinear integrals defined in Eq. (3.15) for $g_I = g_A$ and $g_I = g_B$ analytically.

8.1 The $\mathcal{A}$-type collinear integrals for $k \geq 0$

The collinear integral for $g_I = g_A$ requires the evaluation of an integral of the form

$$\begin{aligned} \mathcal{A}(x, \epsilon; \alpha_0, d_0; \kappa, k) &= \frac{1}{x}\, \mathcal{I}(x, \epsilon; \alpha_0, d_0; \kappa, k, 0, g_A) \\ &= \int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \alpha^{-1-(1+\kappa)\epsilon}(1-\alpha)^{2d_0-1}[\alpha + (1-\alpha)x]^{-1-(1+\kappa)\epsilon} \\ &\quad \times\, v^{-\epsilon}(1-v)^{-\epsilon} \left(\frac{\alpha + (1-\alpha)xv}{2\alpha + (1-\alpha)x}\right)^k, \end{aligned} \tag{8.1}$$

where $k = -1, 0, 1, 2$, $\kappa = 0, 1$ and $d_0 = D_0 + d_1\epsilon$ with D_0 an integer. For $k \geq 0$ this two-dimensional integral decouples into the product of two one-dimensional integrals, out of which one is straightforward,

$$\begin{aligned}\mathcal{A}(x,\epsilon;\alpha_0,d_0;\kappa,k) &= \sum_{j=0}^{k} \binom{k}{j} x^j\, B(1+j-\epsilon, 1-\epsilon) \\ &\times \int_0^{\alpha_0} \mathrm{d}\alpha\, \alpha^{k-j-1-(1+\kappa)\epsilon} (1-\alpha)^{j+2d_0-1} [\alpha+(1-\alpha)x]^{-1-(1+\kappa)\epsilon} [2\alpha+(1-\alpha)x]^{-k}.\end{aligned} \tag{8.2}$$

We will therefore treat separately the cases $k \geq 0$ and $k < 0$.

For $k \geq 0$ the calculation of the $\mathcal{A}$ integrals reduces to the calculation of a one-dimensional integral of the form

$$\begin{aligned}&A_+(x,\epsilon;\alpha_0,d_1;\kappa;n_1,n_2,n_3,n_4) \\ &\quad = \int_0^{\alpha_0} \mathrm{d}\alpha\, \alpha^{-n_1-(1+\kappa)\epsilon} (1-\alpha)^{-n_2+2d_1\epsilon} [\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} [2\alpha+(1-\alpha)x]^{-n_4},\end{aligned} \tag{8.3}$$

n_i being integers. The integration-by-parts identities, including a surface term for the independent integrals, are

$$\begin{aligned}&\int_0^{\alpha_0} \mathrm{d}\alpha\, \frac{\partial}{\partial\alpha} \left(\alpha^{-n_1-(1+\kappa)\epsilon} (1-\alpha)^{-n_2+2d_1\epsilon} [\alpha+(1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} [2\alpha+(1-\alpha)x]^{-n_4} \right) \\ &\quad = \alpha_0^{-n_1-(1+\kappa)\epsilon} (1-\alpha_0)^{-n_2+2d_1\epsilon} [\alpha_0+(1-\alpha_0)x]^{-n_3-(1+\kappa)\epsilon} [2\alpha_0+(1-\alpha_0)x]^{-n_4}.\end{aligned} \tag{8.4}$$

Using the Laporta algorithm we find three master integrals for A_+,

$$\begin{aligned}A_+^{(1)}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_+(x,\epsilon;\alpha_0,d_1;\kappa;0,0,0,0) = \int_0^{\alpha_0} \mathrm{d}\mu_\epsilon(\alpha;x), \\ A_+^{(2)}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_+(x,\epsilon;\alpha_0,d_1;\kappa;-1,0,0,0) = \int_0^{\alpha_0} \mathrm{d}\mu_\epsilon(\alpha;x)\,\alpha, \\ A_+^{(3)}(x,\epsilon;\alpha_0,d_1;\kappa) &= A_+(x,\epsilon;\alpha_0,d_1;\kappa;0,0,0,1) = \int_0^{\alpha_0} \frac{\mathrm{d}\mu_\epsilon(\alpha;x)}{2\alpha+(1-\alpha)x}.\end{aligned} \tag{8.5}$$

where

$$\begin{aligned}\mathrm{d}\mu_\epsilon(\alpha,x) &= \mathrm{d}\alpha\, \alpha^{-(1+\kappa)\epsilon} (1-\alpha)^{2d_1\epsilon} (\alpha+(1-\alpha)\,x)^{-(1+\kappa)\epsilon}, \\ &= \mathrm{d}\alpha + \epsilon\, \mathrm{d}\alpha\big(2d_1\ln(1-\alpha) - (1+\kappa)\ln\alpha - (1+\kappa)\ln(\alpha+x-\alpha x)\big) + \mathcal{O}(\epsilon^2), \\ &= \mathrm{d}\alpha + \epsilon\, \mathrm{d}\alpha\big(-(1+\kappa)H(0;\alpha) - (1+\kappa)H(0;x) - 2d_1H(1;\alpha) - (\kappa+1)H(d_1(x);\alpha)\big) \\ &\quad + \mathcal{O}(\epsilon^2).\end{aligned} \tag{8.6}$$

where we used the d-representation of the two-dimensional *HPL's* defined in Sect. 5,

$$\begin{aligned}H(d_1(x);\alpha) &= \ln\left(1+\frac{1-x}{x}\alpha\right), \\ H(d_1(x),d_1(x);\alpha) &= \frac{1}{2}\ln^2\left(1+\frac{1-x}{x}\alpha\right), \\ &\textit{etc.}\end{aligned} \tag{8.7}$$

Notice that all three master integrals are finite for $\epsilon = 0$. This allows us to expand the integrand into a power series in ϵ and integrate order by order in ϵ, using the defining property of the *HPL's*, Eq. (4.2). We obtain in this way the series expansion of the master integrals as a power series in ϵ whose coefficients are written in terms of the d-representation of the two-dimensional *HPL's* . We can then switch back to the c-representation using the algorithm described in Sect. 5.

Having a representation of the master integrals, we can immediately write down the solutions for $\mathcal{A}(x, \epsilon; \alpha_0, d_0; \kappa, k)$ for $k \geq 0$ and fixed D_0 using Eq. (8.2). In Appendix D we give as an example the series expansions up to order ϵ^2 for $D_0 = 3$.

8.2 The $\mathcal{A}$-type collinear integrals for $k = -1$

For $k = -1$, the integral (8.1) does not decouple, so we have to use the Laporta algorithm to calculate the full two-dimensional integral. However, for $k = -1$, we can get rid of the denominator in $(2\alpha + (1-\alpha)x)$ in the integrand. So we only have to deal with an integral of the form

$$\begin{aligned} &A_-(x, \epsilon; \alpha_0, d_1; \kappa; n_1, n_2, n_3, n_4, n_5, n_6) = \\ &\quad = \int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \alpha^{-n_1-(1+\kappa)\epsilon} (1-\alpha)^{-n_2+2d_1\epsilon} [\alpha + (1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} \\ &\quad \times v^{-n_4-\epsilon} (1-v)^{-n_5-\epsilon} [\alpha + (1-\alpha)xv]^{-n_6}, \end{aligned} \tag{8.8}$$

n_i being integers.

We write down the integration-by-parts identities for A_- including a surface term for α,

$$\begin{aligned} &\int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \frac{\partial}{\partial v} \Big(\alpha^{-n_1-(1+\kappa)\epsilon} (1-\alpha)^{-n_2+2d_1\epsilon} [\alpha + (1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} \\ &\qquad \times v^{-n_4-\epsilon} (1-v)^{-n_5-\epsilon} [\alpha + (1-\alpha)xv]^{-n_6} \Big) = 0\,, \\ &\int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \frac{\partial}{\partial \alpha} \Big(\alpha^{-n_1-(1+\kappa)\epsilon} (1-\alpha)^{-n_2+2d_1\epsilon} [\alpha + (1-\alpha)x]^{-n_3-(1+\kappa)\epsilon} \\ &\qquad \times v^{-n_4-\epsilon} (1-v)^{-n_5-\epsilon} [\alpha + (1-\alpha)xv]^{-n_6} \Big) \\ &\qquad = \alpha_0^{-n_1-(1+\kappa)\epsilon} (1-\alpha_0)^{-n_2+2d_1\epsilon} [\alpha_0 + (1-\alpha_0)x]^{-n_3-(1+\kappa)\epsilon}\, A_{-,S}(x, \epsilon; \alpha_0, d_1; n_4, n_5, n_6)\,, \end{aligned} \tag{8.9}$$

with

$$\begin{aligned} A_{-,S}(x, \epsilon; \alpha_0, d_1; n_4, n_5, n_6) &= \int_0^1 \mathrm{d}v\, v^{-n_4-\epsilon} (1-v)^{-n_5-\epsilon} [\alpha_0 + (1-\alpha_0)xv]^{-n_6} \\ &= \alpha_0^{-n_6} B(1-n_4-\epsilon, 1-n_5-\epsilon)\, {}_2F_1\left(1-n_4-\epsilon, n_6, 2-n_4-n_5-2\epsilon; \frac{\alpha_0-1}{\alpha_0}x\right). \end{aligned} \tag{8.10}$$

As in the case of $\mathcal{K}$ we are going to evaluate this surface term using the Laporta algorithm, especially to get rid of the strange argument the hypergeometric function depends on, and to get an expression for $A_{-,S}$ in terms of two-dimensional *HPL's* in α_0 and x.

Evaluation of the surface term $A_{-,S}$. Because the v integration is over the whole range $[0,1]$, we do not have to take into account a surface term in the integration-by-parts identities for $A_{-,S}$,

$$\int_0^1 \mathrm{d}v\, \frac{\partial}{\partial v}\left(v^{-n_4-\epsilon}(1-v)^{-n_5-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_6}\right)=0. \tag{8.11}$$

Using the Laporta algorithm we see that $A_{-,S}$ has two master integrals,

$$\begin{aligned} A^{(1)}_{-,S}(x,\epsilon;\alpha_0,d_1) &= A_{-,S}(x,\epsilon;\alpha_0,d_1;0,0,0),\\ A^{(2)}_{-,S}(x,\epsilon;\alpha_0,d_1) &= A_{-,S}(x,\epsilon;\alpha_0,d_1;0,0,1). \end{aligned} \tag{8.12}$$

$A^{(i)}_{-,S}(x,\epsilon;\alpha_0,d_1)$, $i=1,2$, are functions of the two variables x and α_0 defined on the square $[0,1]\times[0,1]$, so in principle we should write down a set of partial differential equations for the evolution of both α_0 and x. However, it is easy to see that in $x=0$ we have

$$\begin{aligned} A^{(1)}_{-,S}(x=0,\epsilon;\alpha_0,d_1) &= B(1-\epsilon,1-\epsilon),\\ A^{(2)}_{-,S}(x=0,\epsilon;\alpha_0,d_1) &= \frac{1}{\alpha_0}B(1-\epsilon,1-\epsilon), \end{aligned} \tag{8.13}$$

for arbitrary α_0. So we are in the special situation where we know the solutions on the line $\{x=0\}\times[0,1]$, and so we only need to consider the evolution for the x variable. In other words, we consider $A^{(i)}_{-,S}$ as a function of x only, keeping α_0 as a parameter.

The differential equations for the evolution in the x variable read

$$\begin{aligned} &\frac{\partial}{\partial x}A^{(1)}_{-,S}=0,\\ &\frac{\partial}{\partial x}A^{(2)}_{-,S}=A^{(1)}_{-,S}\left(\frac{1-2\epsilon}{\alpha_0 x}+\frac{(\alpha_0-1)(2\epsilon-1)}{\alpha_0(\alpha_0 x-x-\alpha_0)}\right)+A^{(2)}_{-,S}\left(\frac{2\epsilon-1}{x}-\frac{(\alpha_0-1)\epsilon}{\alpha_0 x-x-\alpha_0}\right), \end{aligned} \tag{8.14}$$

and the initial condition for this system is given by Eq. (8.13). As the system is already triangular, we can immdiately solve for $A^{(1)}_{-,S}$ and $A^{(2)}_{-,S}$. Notice in particular that the denominator in $(\alpha_0+x-x\alpha_0)$ will give rise to two-dimensional *HPL's* of the form $H(c_1(\alpha_0);x)$, *etc.*

Evaluation of A_-. Having an expression for the ϵ-expansion of the surface term, we can solve the integration-by-parts identities for A_-, Eq. (8.9). We find four master integrals,

$$\begin{aligned} A^{(1)}_-(x,\epsilon;\alpha_0,d_1;\kappa) &= A_-(x,\epsilon;\alpha_0,d_1;\kappa;0,0,0,0,0,0),\\ A^{(2)}_-(x,\epsilon;\alpha_0,d_1;\kappa) &= A_-(x,\epsilon;\alpha_0,d_1;\kappa;-1,0,0,0,0,0),\\ A^{(3)}_-(x,\epsilon;\alpha_0,d_1;\kappa) &= A_-(x,\epsilon;\alpha_0,d_1;\kappa;-1,0,0,0,0,1),\\ A^{(4)}_-(x,\epsilon;\alpha_0,d_1;\kappa) &= A_-(x,\epsilon;\alpha_0,d_1;\kappa;-2,0,0,0,0,1). \end{aligned} \tag{8.15}$$

It is easy to see that all of the master integrals are finite for $\epsilon=0$.

As in the case of the surface terms, we are only interested in the x evolution, because the master integrals are known for $x=0$ for any value of α_0,

$$\begin{aligned} A^{(1)}_-(x=0,\epsilon;\alpha_0,d_1;\kappa) &= B_{\alpha_0}(1-2(1+\kappa)\epsilon,1+2d_1\epsilon)\,B(1-\epsilon,1-\epsilon)\,,\\ A^{(2)}_-(x=0,\epsilon;\alpha_0,d_1;\kappa) &= B_{\alpha_0}(2-2(1+\kappa)\epsilon,1+2d_1\epsilon)\,B(1-\epsilon,1-\epsilon)\,, \end{aligned} \tag{8.16}$$

and

$$
\begin{aligned}
A_-^{(3)}(x=0,\epsilon;\alpha_0,d_1;\kappa) &= A_-^{(1)}(x=0,\epsilon;\alpha_0,d_1;\kappa)\,,\\
A_-^{(4)}(x=0,\epsilon;\alpha_0,d_1;\kappa) &= A_-^{(2)}(x=0,\epsilon;\alpha_0,d_1;\kappa)\,.
\end{aligned}
\tag{8.17}
$$

The master integrals $A_-^{(1)}$ and $A_-^{(2)}$ form a subtopology, *i.e.* the differential equations for these two master integrals close under themselves:

$$
\begin{aligned}
\frac{\partial}{\partial x}A_-^{(1)} =&\frac{1-2(1+\kappa)\epsilon}{x}\,A_-^{(1)} - \frac{2(d_1\epsilon-(1+\kappa)\epsilon+1)}{x}\,A_-^{(2)}\\
&- \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{1-(1+\kappa)\epsilon}}{x}\,A_{-,S}^{(1)},\\
\frac{\partial}{\partial x}A_-^{(2)} =&\frac{1-(1+\kappa)\epsilon}{x-1}\,A_-^{(1)} + \frac{-2d_1\epsilon+(1+\kappa)\epsilon-2}{x-1}\,A_-^{(2)}\\
&- \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{1-(1+\kappa)\epsilon}}{x-1}\,A_{-,S}^{(1)}.
\end{aligned}
\tag{8.18}
$$

The two equations can be triangularized by the change of variable

$$
\begin{aligned}
\tilde{A}_-^{(1)} &= A_-^{(1)} - 2A_-^{(2)},\\
\tilde{A}_-^{(2)} &= A_-^{(2)}.
\end{aligned}
\tag{8.19}
$$

The equations for the subtopology now take the triangularized form

$$
\begin{aligned}
\frac{\partial}{\partial x}\tilde{A}_-^{(1)} =& \left(\frac{2\epsilon-2}{x-1}+\frac{1-2\epsilon}{x}\right)\,\tilde{A}_-^{(1)} + \left(\frac{4d_1+2}{x-1}-\frac{2d_1+2}{x}\right)\,\epsilon\,\tilde{A}_-^{(2)}\\
&+ (1-\alpha_0)^{2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\alpha_0^{1-\epsilon}\left(\frac{2-2\alpha_0}{x-1}+\frac{\alpha_0-1}{x}\right)\,A_{-,S}^{(1)},\\
\frac{\partial}{\partial x}\tilde{A}_-^{(2)} =& \frac{1-\epsilon}{x-1}\tilde{A}_-^{(1)} - \frac{2d_1+1}{x-1}\,\epsilon\,\tilde{A}_-^{(2)} + (1-\alpha_0)^{2d_1\epsilon}\alpha_0^{1-\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\frac{a-1}{x-1}\,A_{-,S}^{(1)}.
\end{aligned}
\tag{8.20}
$$

The initial condition for $\tilde{A}_-^{(2)}$ can be obtained from Eq. (8.16). For $\tilde{A}_-^{(1)}$ however, Eq. (8.16) gives only trivial information. Furthermore, the solution of the differential equation has in general a pole in $x=1$, but it is easy to convince oneself that $\tilde{A}_-^{(1)}$ is finite in $x=1$, which serves as the initial condition.

We can now solve for the remaining two master integrals. The differential equations for $A_-^{(3)}$ and $A_-^{(4)}$ read

$$
\begin{aligned}
\frac{\partial}{\partial x}A_-^{(3)} =&\frac{1-2(1+\kappa)\epsilon}{x}\,A_-^{(3)} - \frac{2(d_1\epsilon-(1+\kappa)\epsilon+1)}{x}\,A_-^{(4)}\\
&- \frac{(1-\alpha_0)^{2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{2-(1+\kappa)\epsilon}}{x}\,A_{-,S}^{(2)},\\
\frac{\partial}{\partial x}A_-^{(4)} =& \left(\frac{1-2\epsilon}{x}+\frac{2\epsilon-1}{x-1}\right)\,A_-^{(2)} - \frac{(2+\kappa)\epsilon-2}{x-1}\,A_-^{(3)}\\
&+ \left(\frac{2\epsilon-1}{x}-\frac{(2d_1+\kappa)\epsilon)}{x-1}\right)\,A_-^{(4)}\\
&- \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-(1+\kappa)\epsilon}\alpha_0^{2-(1+\kappa)\epsilon}}{x-1}\,A_{-,S}^{(2)}.
\end{aligned}
\tag{8.21}
$$

These equations can be brought into a triangularized form via the change of variable

$$\begin{aligned}\tilde{A}_-^{(3)} &= A_-^{(3)} - A_-^{(4)}, \\ \tilde{A}_-^{(4)} &= A_-^{(4)},\end{aligned} \tag{8.22}$$

and Eq. (8.21) now reads

$$\begin{aligned}\frac{\partial}{\partial x}\tilde{A}_-^{(3)} =& \left(\frac{1-2\epsilon}{x} + \frac{2(\epsilon-1)}{x-1}\right)\tilde{A}_-^{(3)} + \left(\frac{2(d_1+1)\epsilon}{x-1} - \frac{2(d_1+1)\epsilon}{x}\right)\tilde{A}_-^{(4)} \\ &- (1-\alpha_0)^{1+2d_1\epsilon}\alpha_0^{2-\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\left(\frac{1}{x} - \frac{1}{x-1}\right)A_{-,S}^{(2)} \\ &+ \left(\frac{1-2\epsilon}{x-1} + \frac{2\epsilon-1}{x}\right)A_-^{(2)}, \\ \frac{\partial}{\partial x}\tilde{A}_-^{(4)} =& \frac{2-2\epsilon}{x-1}\tilde{A}_-^{(3)} + \left(\frac{2\epsilon-1}{x} - \frac{2(d_1\epsilon+\epsilon)}{x-1}\right)\tilde{A}_-^{(4)} \\ &+ \left(\frac{1-2\epsilon}{x} + \frac{2\epsilon-1}{x-1}\right)A_-^{(2)} - \frac{(1-\alpha_0)^{1+2d_1\epsilon}(-x\alpha_0+\alpha_0+x)^{-\epsilon}\alpha_0^{2-\epsilon}}{x-1}A_{-,S}^{(2)}.\end{aligned} \tag{8.23}$$

The initial condition for $A_-^{(3)}$ and $A_-^{(4)}$ can again be obtained from Eq. (8.16) and requiring $A_-^{(3)}$ to be finite in $x = 1$.

Having the analytic expressions for the master integrals, we can now easily obtain the solutions for $\mathcal{A}$ for $k = -1$ for a fixed value of D_0. The results for $D_0 = 3$ can be found in Appendix D.

In Fig. 4 we compare the analytic and numeric results for the ϵ^2 coefficient in the expansion of $\mathcal{I}(x, \epsilon; \alpha_0, 3-3\epsilon; 1, k, 0, g_A)$ for $k = -1, 2$ and $\alpha_0 = 0.1, 1$ as representative examples. The dependence on α_0 is not visible on the plots. The agreement between the two computations is excellent for the whole x-range. We find a similar agreement for other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters.

8.3 The $\mathcal{B}$-type collinear integrals

The $\mathcal{B}$-type collinear integrals require the evaluation of an integral of the form

$$\begin{aligned}\mathcal{B}(x,\epsilon;\alpha_0,d_0;\delta,k) &= \frac{1}{x}\mathcal{I}(x,\epsilon;\alpha_0,d_0;1,k,\delta,g_B) \\ &= \int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\alpha^{-1-2\epsilon}(1-\alpha)^{2d_0-1}[\alpha+(1-\alpha)x]^{-1-2\epsilon}[2\alpha+(1-\alpha)x]^{-k} \\ &\times\, v^{-\epsilon}(1-v)^{-\epsilon}[\alpha+(1-\alpha)xv]^{k+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-\delta\epsilon},\end{aligned} \tag{8.24}$$

where $k = -1, 0, 1, 2$, $\delta = \pm 1$ and $d_0 = D_0 + d_1\epsilon$ (as before D_0 is an integer). Unlike the $\mathcal{A}$-type integrals, the $\mathcal{B}$-type integrals do not decouple for $k \geq 0$, due to the appearance of the ϵ pieces in the exponents, so we have to consider the denominators altogether, and have to deal with an integral of the form

$$\begin{aligned}&B(x,\epsilon;\alpha_0,d_1;\delta;n_1,n_2,n_3,n_4,n_5,n_6,n_7,n_8) = \\ &\quad= \int_0^{\alpha_0}\mathrm{d}\alpha\int_0^1\mathrm{d}v\,\alpha^{-n_1-2\epsilon}(1-\alpha)^{-n_2+2d_1}[\alpha+(1-\alpha)x]^{-n_3-2\epsilon}[2\alpha+(1-\alpha)x]^{-n_4} \\ &\quad\times\, v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha+(1-\alpha)xv]^{-n_7+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-n_8-\delta\epsilon}.\end{aligned} \tag{8.25}$$

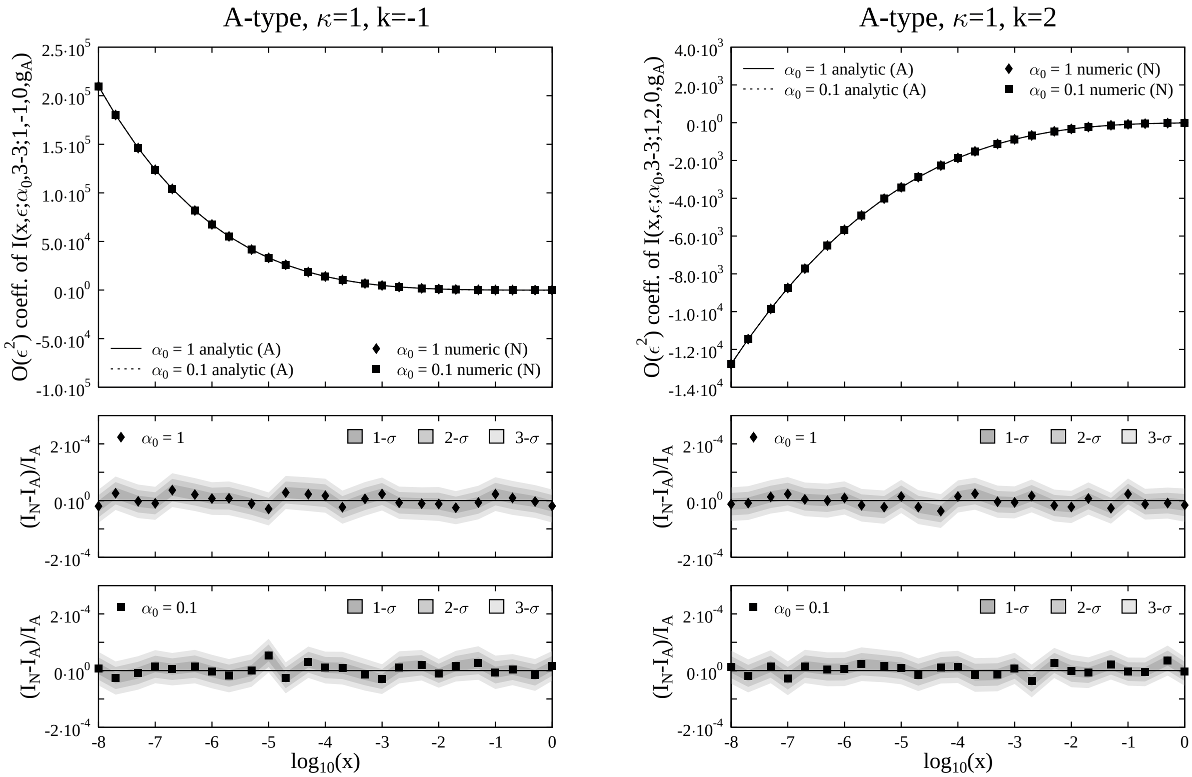

Figure 4: Representative results for the $\mathcal{A}$-type integrals. The plots show the coefficient of the $\mathrm{O}(\epsilon^2)$ term in $\mathcal{I}(x,\epsilon;\alpha_0,3-3\epsilon;1,k,0,g_A)$ for $k=-1$ (left figure) and $k=2$ (right figure) with $\alpha_0 = 0.1, 1$.

We use again the Laporta algorithm, and write down the integration-by-parts identities for B,

$$
\begin{aligned}
&\int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v \, \frac{\partial}{\partial v} \Big(\alpha^{-n_1-2\epsilon}(1-\alpha)^{-n_2+2d_1}[\alpha+(1-\alpha)x]^{-n_3-2\epsilon}[2\alpha+(1-\alpha)x]^{-n_4} \\
&\qquad\qquad \times v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha+(1-\alpha)xv]^{-n_7+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-n_8-\delta\epsilon} \Big) \\
&\qquad = 0, \\
&\int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v \, \frac{\partial}{\partial \alpha} \Big(\alpha^{-n_1-2\epsilon}(1-\alpha)^{-n_2+2d_1}[\alpha+(1-\alpha)x]^{-n_3-2\epsilon}[2\alpha+(1-\alpha)x]^{-n_4} \\
&\qquad\qquad \times v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha+(1-\alpha)xv]^{-n_7+\delta\epsilon}[\alpha+(1-\alpha)(1-v)x]^{-n_8-\delta\epsilon} \Big) \\
&\quad = \alpha_0^{-n_1-2\epsilon}(1-\alpha_0)^{-n_2+2d_1}[\alpha_0+(1-\alpha_0)x]^{-n_3-2\epsilon}[2\alpha_0+(1-\alpha_0)x]^{-n_4} \\
&\qquad\qquad \times B_S(x,\epsilon;\alpha_0,d_1;\delta,k;n_5,n_6,n_7,n_8),
\end{aligned}
$$

where the surface term is given by

$$
\begin{aligned}
&B_S(x,\epsilon;\alpha_0,d_1;\delta;n_5,n_6,n_7,n_8) = \\
&\qquad = \int_0^1 \mathrm{d}v \, v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_7+\delta\epsilon}[\alpha_0+(1-\alpha_0)(1-v)x]^{-n_8-\delta\epsilon}.
\end{aligned}
\tag{8.26}
$$

Evaluation of the surface term B_S. The surface term B_S is no longer a hypergeometric function as it was the case for the $\mathcal{K}$ and $\mathcal{A}$-type integrals. It can nevertheless be easily calculated using the Laporta algorithm. The integration-by-parts identities for B_S read

$$\int_0^1 \mathrm{d}v\, \frac{\partial}{\partial v}\left(v^{-n_5-\epsilon}(1-v)^{-n_6-\epsilon}[\alpha_0+(1-\alpha_0)xv]^{-n_7+\delta\epsilon}[\alpha_0+(1-\alpha_0)(1-v)x]^{-n_8-\delta\epsilon}\right)=0. \tag{8.27}$$

We find three master integrals for B_S,

$$\begin{aligned}
B_S^{(1)}(x,\epsilon;\alpha_0,d_1;\delta) &= B_S(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0),\\
B_S^{(2)}(x,\epsilon;\alpha_0,d_1;\delta) &= B_S(x,\epsilon;\alpha_0,d_1;\delta;-1,0,0,0),\\
B_S^{(3)}(x,\epsilon;\alpha_0,d_1;\delta) &= B_S(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0),
\end{aligned} \tag{8.28}$$

fulfilling the differential equations

$$\begin{aligned}
\frac{\partial}{\partial x}B_S^{(1)} =& B_S^{(1)}\left(\frac{2\left(\epsilon\alpha_0-\alpha_0-\epsilon+1\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)}+\frac{-2\alpha_0\epsilon^2+2\epsilon^2+3\alpha_0\delta\epsilon-3\delta\epsilon-\alpha_0+1}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(\epsilon\delta-1\right)}\right.\\
&\left.+\frac{-2\delta\epsilon^2+2\epsilon^2-\delta\epsilon+2\epsilon-1}{\alpha_0 x(\epsilon\delta-1)}\right)\\
&+B_S^{(2)}\left(\frac{4\left(\alpha_0-1\right)\left(\epsilon-1\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)}-\frac{4\left(\alpha_0-1\right)\left(\epsilon-1\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)}\right)\\
&+B_S^{(3)}\left(\frac{\left(\alpha_0-1\right)\left(\delta\epsilon^2-\epsilon^2-\epsilon+1\right)}{\left(x\alpha_0-\alpha_0-x\right)\left(\epsilon\delta-1\right)}+\frac{2\delta\epsilon^2-2\epsilon^2+\delta\epsilon-2\epsilon+1}{x(\epsilon\delta-1)}\right.\\
&\left.-\frac{\left(\alpha_0-1\right)\left(2\delta\epsilon^2-2\epsilon^2+\delta\epsilon-2\epsilon+1\right)}{\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(\epsilon\delta-1\right)}\right),\\
\frac{\partial}{\partial x}B_S^{(2)} =& -B_S^{(1)}\frac{(-\delta\epsilon+\epsilon-1)}{x}+B_S^{(2)}\frac{2(\epsilon-1)}{x}-B_S^{(3)}\frac{\alpha_0\epsilon\delta}{x},\\
\frac{\partial}{\partial x}B_S^{(3)} =& B_S^{(1)}\left(-\frac{\delta\left(2\alpha_0\epsilon^2-2\epsilon^2-2\alpha_0\epsilon-2\alpha_0\delta\epsilon+2\delta\epsilon+2\epsilon+2\alpha_0\delta-2\delta\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)\left(1-\epsilon\delta\right)}\right.\\
&\left.+\frac{2\delta\epsilon^2-2\epsilon^2+\delta\epsilon-2\epsilon+1}{\alpha_0 x(1-\epsilon\delta)}-\frac{\delta\left(-2\alpha_0\delta\epsilon^2+2\delta\epsilon^2+3\alpha_0\epsilon-3\epsilon-\alpha_0\delta+\delta\right)}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(1-\epsilon\delta\right)}\right)\\
&+B_S^{(2)}\left(\frac{2\left(\alpha_0-1\right)\left(\epsilon-1\right)(2\epsilon-2\delta)\delta}{\alpha_0\left(\left(\alpha_0-1\right)x-2\alpha_0\right)\left(1-\epsilon\delta\right)}-\frac{2\left(\alpha_0-1\right)\left(\epsilon-1\right)(2\epsilon-2\delta)\delta}{\alpha_0\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(1-\epsilon\delta\right)}\right)\\
&+B_S^{(3)}\left(\frac{-2\delta\epsilon^2+2\epsilon^2-\delta\epsilon+2\epsilon-1}{x(1-\epsilon\delta)}-\frac{\left(\alpha_0-1\right)\left(-2\delta\epsilon^2+2\epsilon^2-\delta\epsilon+2\epsilon-1\right)}{\left(\left(\alpha_0-1\right)x-\alpha_0\right)\left(1-\epsilon\delta\right)}\right.\\
&\left.+\frac{\left(\alpha_0-1\right)\left(-\delta\epsilon^2+\epsilon^2+\epsilon-1\right)}{\left(x\alpha_0-\alpha_0-x\right)\left(1-\epsilon\delta\right)}\right).
\end{aligned} \tag{8.29}$$

The initial conditions for the differential equations are

$$\begin{aligned}
B_S^{(1)}(x=0,\epsilon;\alpha_0,d_1;\delta) &= B(1-\epsilon,1-\epsilon),\\
B_S^{(2)}(x=0,\epsilon;\alpha_0,d_1;\delta) &= B(2-\epsilon,1-\epsilon),\\
B_S^{(3)}(x=0,\epsilon;\alpha_0,d_1;\delta) &= \frac{1}{\alpha_0}B(1-\epsilon,1-\epsilon),
\end{aligned} \tag{8.30}$$

The system can be triangularized by the change of variable

$$\tilde{B}_S^{(1)} = B_S^{(1)} - 2B_S^{(2)}, \quad \tilde{B}_S^{(2)} = B_S^{(2)}, \quad \tilde{B}_S^{(3)} = B_S^{(3)}, \tag{8.31}$$

and then solved in the usual way.

Evaluation of the B integral. Solving the integration-by-parts identities for the B integrals, we find nine master integrals

$$\begin{aligned}
B^{(1)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0,0,0,0,0),\\
B^{(2)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0,0,0,0,1),\\
B^{(3)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,0,0,0,1,0),\\
B^{(4)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,1,0,0,0,0),\\
B^{(5)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0,0,0,0,0),\\
B^{(6)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;-1,0,0,0,0,0,1,0),\\
B^{(7)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,0,1,0,0,1,0),\\
B^{(8)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0,0,0,1,0),\\
B^{(9)}(x,\epsilon;\alpha_0,d_1;\delta) &= B(x,\epsilon;\alpha_0,d_1;\delta;0,0,1,0,0,0,0,1),
\end{aligned} \tag{8.32}$$

The master integrals $B^{(i)}$, $i \neq 4,7$, form a subtopology, *i.e.* the differential equations for these master integrals close under themselves. Furthermore the differential equations for $B^{(1)}, B^{(3)}, B^{(5)}$ and $B^{(6)}$ have a triangular structure in ϵ, *i.e.* all other master integrals are suppressed by a power of ϵ. For $\delta = +1$, the corresponding differential equations are given by

$$\frac{\partial}{\partial x}B^{(1)} = \frac{2(\varepsilon-1)B_S^{(2)}(\alpha_0-1)^2}{(2d_1\varepsilon-4\,\varepsilon+1)(x\alpha_0-\alpha_0-x)} - \frac{2\varepsilon\ B^{(1)}}{x-1} + \left(\frac{4\varepsilon^2}{(2d_1\varepsilon-4\varepsilon\ +1)(x-1)} - \frac{\varepsilon(8\varepsilon-1)}{(2d_1\varepsilon-4\ \varepsilon+1)x}\right)B^{(2)} + \left(\frac{2\varepsilon^2}{(2d_1\ \varepsilon-4\varepsilon+1)(x-1)} - \frac{\varepsilon(4\varepsilon-1)}{(2\ d_1\varepsilon-4\varepsilon+1)x}\right)B^{(3)} + \left(\frac{2\varepsilon}{x-1} + \frac{2(2\varepsilon-1)\varepsilon}{(2d_1\varepsilon-4\varepsilon\ +1)x}\right)B^{(5)} - \frac{2\varepsilon B^{(6)}}{x} - \frac{2\varepsilon^2\ B^{(8)}}{(2d_1\varepsilon-4\varepsilon+1)(x-1)} - \frac{4\varepsilon^2\ B^{(9)}}{(2d_1\varepsilon-4\varepsilon+1)(x-1)} + \left(-\frac{2\ \varepsilon(\alpha_0-1)^2}{(2d_1\varepsilon-4\varepsilon+1)((\alpha_0-1)\ x-\alpha_0)} + \frac{(\alpha_0-1)^2}{(2d_1\varepsilon-4\varepsilon+1)(x\ \alpha_0-\alpha_0-x)} + \frac{2\varepsilon(\alpha_0-1)}{(2d_1\varepsilon-4\varepsilon\ +1)x}\right)B_S^{(1)},$$

$$\frac{\partial}{\partial x}B^{(3)} = -\frac{4\epsilon B^{(3)}}{x} + \frac{(-2d_1\epsilon+4\epsilon-1)\ B^{(6)}}{x} + \frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x},$$

$$\frac{\partial}{\partial x}B^{(5)} = \left(\frac{-2d_1\epsilon+4\epsilon-1}{x} + \frac{2d_1\epsilon-4\epsilon\ +1}{x-1}\right)B^{(1)} + \left(\frac{-2d_1\epsilon+4\epsilon-1}{x-1} - \frac{4\ \epsilon}{x}\right)B^{(5)} + \left(\frac{\alpha_0-1}{x} - \frac{(\alpha_0-1)^2}{(\alpha_0-1)\ x-\alpha_0}\right)B_S^{(1)},$$

$$\frac{\partial}{\partial x}B^{(6)} = \left(\frac{1-2\epsilon}{x} + \frac{2\epsilon-1}{x-1}\right)\ B^{(1)} + \left(\frac{8\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\ (x-1)} - \frac{\epsilon}{(2d_1\epsilon-4\epsilon+1)(x-2)} - \frac{(8\epsilon-1)\ \epsilon}{(2d_1\epsilon-4\epsilon+1)x}\right)B^{(2)} + \left(-\frac{2\epsilon}{(x-1)^2} + \frac{2d_1\epsilon-5\epsilon+1}{(2d_1\epsilon-4\epsilon+1)\ (x-2)} - \frac{2(2d_1\epsilon^2-6\epsilon^2+\epsilon)}{(2d_1\epsilon\ -4\epsilon+1)(x-1)} + \frac{\epsilon-4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\ x}\right)B^{(3)} + \left(\frac{1-2\epsilon}{x-1} + \frac{4d_1\epsilon^2-12\ \epsilon^2-2d_1\epsilon+8\epsilon-1}{(2d_1\epsilon-4\epsilon+1)(x-2)} + \frac{2\ \epsilon(2\epsilon-1)}{(2d_1\epsilon-4\epsilon+1)x}\right)\ B^{(5)} + \left(-\frac{2\epsilon}{x-1} + \frac{-2d_1\epsilon+4\epsilon-1}{x-2} - \frac{1}{x}\right)B^{(6)} + \left(\frac{2\epsilon}{(x-1)^2} - \frac{4(2\ d_1\epsilon^2-5\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)\ (x-2)} + \frac{4(2d_1\epsilon^2-5\epsilon^2+\epsilon)}{(2d_1\epsilon\ -4\epsilon+1)(x-1)}\right)B^{(8)} + \left(\frac{8\epsilon^2}{(2d_1\epsilon-4\ \epsilon+1)(x-2)} - \frac{8\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-1)}\right)\ B^{(9)} +$$

$$
\begin{aligned}
&\left(\frac{4(\alpha_0-1)^3(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)}-\right.\\
&\left.\frac{4(\alpha_0-1)^2(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)(x-2)}\right)B_S^{(2)}+\\
&\left(-\frac{2(2\epsilon-1)\,(\alpha_0-1)^3}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)}+\frac{2\,\epsilon(\alpha_0-1)}{(2d_1\epsilon-4\epsilon+1)x}+\right.\\
&\left.\frac{2(\epsilon\,\alpha_0^2-\alpha_0^2-\epsilon\alpha_0+2\alpha_0-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)\,(x-2)}\right)B_S^{(1)}+\frac{(\alpha_0-1)\alpha_0B_S^{(3)}}{x-2},
\end{aligned}
\tag{8.33}
$$

whereas for $\delta=-1$, the differential equations are

$$
\begin{aligned}
\frac{\partial}{\partial x}B^{(1)}=&\frac{2(\epsilon-1)B_S^{(2)}(\alpha_0-1)^2}{(2d_1\epsilon-4\epsilon+1)(x\,\alpha_0-\alpha_0-x)}-\frac{2\epsilon B^{(1)}}{x-1}+\left(\frac{\epsilon(4\epsilon-1)}{(2d_1\epsilon-4\epsilon+1)x}-\right.\\
&\left.\frac{2\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-1)}\right)B^{(2)}+\left(\frac{\epsilon(8\epsilon-1)}{(2d_1\epsilon-4\,\epsilon+1)x}-\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-1)}\right)\\
&B^{(3)}+\left(\frac{2\epsilon}{x-1}-\frac{2\epsilon(2\epsilon-1)}{(2d_1\,\epsilon-4\epsilon+1)x}\right)B^{(5)}+\frac{2\epsilon B^{(6)}}{x}+\frac{4\,\epsilon^2B^{(8)}}{(2d_1\epsilon-4\epsilon+1)(x-1)}+\\
&\frac{2\epsilon^2\,B^{(9)}}{(2d_1\epsilon-4\epsilon+1)(x-1)}+\left(\frac{2\epsilon\,(\alpha_0-1)^2}{(2d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)}-\right.\\
&\left.\frac{(2\epsilon-1)\,(\alpha_0-1)^2}{(2d_1\epsilon-4\epsilon+1)(x\alpha_0-\alpha_0-x)}-\frac{2\epsilon\,(\alpha_0-1)}{(2d_1\epsilon-4\epsilon+1)x}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(3)}=&-\frac{4\epsilon B^{(3)}}{x}+\frac{(-2d_1\epsilon+4\epsilon-1)\,B^{(6)}}{x}+\frac{(\alpha_0-1)\alpha_0B_S^{(3)}}{x},\\
\frac{\partial}{\partial x}B^{(5)}=&\left(\frac{-2d_1\epsilon+4\epsilon-1}{x}+\frac{2d_1\epsilon-4\epsilon+1}{x-1}\right)B^{(1)}+\left(\frac{-2d_1\epsilon+4\epsilon-1}{x-1}-\frac{4\,\epsilon}{x}\right)B^{(5)}+\\
&\left(\frac{\alpha_0-1}{x}-\frac{(\alpha_0-1)^2}{(\alpha_0-1)\,x-\alpha_0}\right)B_S^{(1)},\\
\frac{\partial}{\partial x}B^{(6)}=&\left(\frac{1-2\epsilon}{x}+\frac{2\epsilon-1}{x-1}\right)B^{(1)}+\left(-\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\,(x-1)}+\right.\\
&\left.\frac{\epsilon}{(2d_1\epsilon-4\epsilon+1)(x-2)}+\frac{(4\epsilon-1)\,\epsilon}{(2d_1\epsilon-4\epsilon+1)x}\right)B^{(2)}+\left(-\frac{4\epsilon}{(x-1)^2}+\right.\\
&\left.\frac{2d_1\epsilon-3\epsilon+1}{(2d_1\epsilon-4\epsilon+1)\,(x-2)}-\frac{4(2d_1\epsilon^2-2\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)(x-1)}+\frac{8\epsilon^2-\epsilon}{(2d_1\epsilon-4\epsilon+1)\,x}\right)B^{(3)}+\\
&\left(\frac{1-2\epsilon}{x-1}+\frac{4d_1\epsilon^2-4\epsilon^{\,2}-2d_1\epsilon+4\epsilon-1}{(2d_1\epsilon-4\epsilon+1)(x-2)}-\frac{2\epsilon\,(2\epsilon-1)}{(2d_1\epsilon-4\epsilon+1)x}\right)B^{(5)}+\left(-\frac{4\,\epsilon}{x-1}+\right.
\end{aligned}
\tag{8.34}
$$

$$
\frac{-2d_1\epsilon+4\epsilon-1}{x-2}+\frac{4\epsilon-1}{x}\Bigg)B^{(6)}+\Bigg(\frac{4\epsilon}{(x-1)^2}-\frac{8(2d_1\epsilon^2-3\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)(x-2)}+
$$

$$
\frac{8\,(2d_1\epsilon^2-3\epsilon^2+\epsilon)}{(2d_1\epsilon-4\epsilon+1)\,(x-1)}\Bigg)B^{(8)}+\Bigg(\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)\,(x-1)}-
$$

$$
\frac{4\epsilon^2}{(2d_1\epsilon-4\epsilon+1)(x-2)}\Bigg)\,B^{(9)}+\Bigg(\frac{4(\alpha_0-1)^3(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)}-
$$

$$
\frac{4(\alpha_0-1)^2(\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)(x-2)}\Bigg)B_S^{(2)}+
$$

$$
\Bigg(\frac{2(\alpha_0-1)^3}{(\alpha_0-2)(2\,d_1\epsilon-4\epsilon+1)((\alpha_0-1)x-\alpha_0)}-\frac{2\epsilon(\alpha_0-1)}{(2d_1\,\epsilon-4\epsilon+1)x}+
$$

$$
\frac{2(\epsilon\alpha_0^2-\alpha_0^2-3\epsilon\alpha_0+2\,\alpha_0+2\epsilon-1)}{(\alpha_0-2)(2d_1\epsilon-4\epsilon+1)(x-2)}\Bigg)\,B_S^{(1)}+\frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x-2}.
$$

The differential equations for $B^{(2)}, B^{(8)}$ and $B^{(9)}$ read, for $\delta=+1$,

$$
\begin{aligned}
\frac{\partial}{\partial x}B^{(2)} &= \left(\frac{4\epsilon-1}{x}-\frac{4\epsilon}{x-1}\right)B^{(2)}+\left(\frac{4\epsilon-1}{x}-\frac{2\epsilon}{x-1}\right)B^{(3)}-\frac{2(2\epsilon-1)B^{(5)}}{x}+\\
&\quad \frac{(2d_1\epsilon-4\epsilon+1)\,B^{(6)}}{x}+\frac{2\epsilon B^{(8)}}{x-1}+\frac{4\epsilon\,B^{(9)}}{x-1}-\frac{(\alpha_0-1)\alpha_0 B_S^{(3)}}{x},\\
\frac{\partial}{\partial x}B^{(8)} &= \left(\frac{2(d_1-2)\epsilon}{x-1}-\frac{2(d_1-2)\epsilon}{x}\right)B^{(3)}+\left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon)}{x-1}\right)B^{(8)}+\\
&\quad \left(\frac{\alpha_0-1}{x}-\frac{(\alpha_0-1)^2}{(\alpha_0-1)x-\alpha_0}\right)B_S^{(3)},\\
\frac{\partial}{\partial x}B^{(9)} &= -\frac{2(\epsilon-1)B_S^{(2)}(\alpha_0-1)^2}{\epsilon(x\,\alpha_0-\alpha_0-x)^2}+\left(\frac{2(d_1-2)\epsilon}{x-1}-\frac{2(d_1-2)\epsilon}{x}\right)B^{(2)}+\\
&\quad \left(\frac{-4\epsilon-1}{x}-\frac{2(d_1\epsilon-2\epsilon)}{x-1}\right)B^{(9)}+\Bigg(-\frac{2(\alpha_0-1)^2}{\alpha_0(x\,\alpha_0-\alpha_0-x)}+\frac{2(\alpha_0-1)}{\alpha_0 x}+\\
&\quad \frac{2\epsilon\alpha_0^2-\alpha_0^2-4\epsilon\,\alpha_0+2\alpha_0+2\epsilon-1}{\epsilon(x\alpha_0-\alpha_0-x)^2}\Bigg)\,B_S^{(1)}+\left(\frac{(\alpha_0-1)^2}{(\alpha_0-1)x-\alpha_0}+\frac{1-\alpha_0}{x}\right)B_S^{(3)},
\end{aligned}
\tag{8.35}
$$

and for $\delta = -1$

$$\frac{\partial}{\partial x}B^{(2)} = \left(-\frac{2\epsilon}{x-1} - \frac{1}{x}\right)B^{(2)} + \left(\frac{8\epsilon\ -1}{x} - \frac{4\epsilon}{x-1}\right)B^{(3)} - \frac{2(2\epsilon-1)\ B^{(5)}}{x} +$$
$$\frac{(2d_1\epsilon - 4\epsilon + 1)B^{(6)}}{x} + \frac{4\epsilon\ B^{(8)}}{x-1} + \frac{2\epsilon B^{(9)}}{x-1} - \frac{(\alpha_0-1)\alpha_0\ B_S^{(3)}}{x},$$
$$\frac{\partial}{\partial x}B^{(8)} = \left(\frac{2(d_1-2)\epsilon}{x-1} - \frac{2(d_1-2)\epsilon}{x}\right)\ B^{(3)} + \left(\frac{-4\epsilon-1}{x} - \frac{2(d_1\epsilon - 2\epsilon\ )}{x-1}\right)B^{(8)} +$$
$$\left(\frac{\alpha_0-1}{x} - \frac{(\alpha_0-1)^2}{(\alpha_0-1)x-\ \alpha_0}\right)B_S^{(3)}, \tag{8.36}$$
$$\frac{\partial}{\partial x}B^{(9)} = \frac{2(\epsilon-1)B_S^{(2)}(\alpha_0-1)^2}{\epsilon(x\ \alpha_0 - \alpha_0 - x)^2} + \left(\frac{2(d_1-2)\epsilon}{x-1} - \frac{2(d_1-2)\epsilon}{x}\right)B^{(2)} +$$
$$\left(\frac{-4\epsilon-1}{x} - \frac{2(d_1\epsilon - 2\epsilon\ )}{x-1}\right)B^{(9)} + \left(-\frac{2(\alpha_0-1)^2}{\alpha_0(x\ \alpha_0 - \alpha_0 - x)} + \frac{(\alpha_0-1)^2}{\epsilon(x\alpha_0 - \alpha_0 - x)^2} +\right.$$
$$\left.\frac{2(\alpha_0-1)}{\alpha_0 x}\right)B_S^{(1)} + \left(\frac{(\alpha_0-1)^2}{(\alpha_0-1)\ x - \alpha_0} + \frac{1-\alpha_0}{x}\right)B_S^{(3)}.$$

Knowing the solutions for the subtopology, we can solve for the remaining two master integrals $B^{(4)}$ and $B^{(7)}$. They fulfill the following differential equations, for $\delta = +1$,

$$\frac{\partial}{\partial x}B^{(4)} = \left(\frac{-2d_1\epsilon + 4\epsilon - 1}{2x} + \frac{2d_1\epsilon - 4\epsilon\ +1}{2(x-2)}\right)B^{(1)} + \left(\frac{-2d_1\epsilon + 4\epsilon\ -1}{x-2} - \frac{4\epsilon}{x}\right)B^{(4)} +$$
$$\left(\frac{\alpha_0-1}{2\ x} - \frac{(\alpha_0-1)^2}{2((\alpha_0-1)x - 2\alpha_0)}\right)B_S^{(1)},$$
$$\frac{\partial}{\partial x}B^{(7)} = \left(\frac{(d_1-2)\epsilon}{x-2} - \frac{(d_1-2)\epsilon}{x}\right)\ B^{(3)} + \left(\frac{-4\epsilon-1}{x} - \frac{2(d_1\epsilon - 2\epsilon\ )}{x-2}\right)B^{(7)} +$$
$$\left(\frac{\alpha_0-1}{2x} - \frac{(\alpha_0-1)^2}{2\ ((\alpha_0-1)x - 2\alpha_0)}\right)B_S^{(3)}, \tag{8.37}$$

whereas for $\delta = -1$ the differential equations read

$$\frac{\partial}{\partial x}B^{(4)} = \left(\frac{-2d_1\epsilon + 4\epsilon - 1}{2x} + \frac{2d_1\epsilon - 4\epsilon\ +1}{2(x-2)}\right)B^{(1)} + \left(\frac{-2d_1\epsilon + 4\epsilon\ -1}{x-2} - \frac{4\epsilon}{x}\right)B^{(4)} +$$
$$\left(\frac{\alpha_0-1}{2\ x} - \frac{(\alpha_0-1)^2}{2((\alpha_0-1)x - 2\alpha_0)}\right)B_S^{(1)},$$
$$\frac{\partial}{\partial x}B^{(7)} = \left(\frac{(d_1-2)\epsilon}{x-2} - \frac{(d_1-2)\epsilon}{x}\right)\ B^{(3)} + \left(\frac{-4\epsilon-1}{x} - \frac{2(d_1\epsilon - 2\epsilon\ )}{x-2}\right)B^{(7)} +$$
$$\left(\frac{\alpha_0-1}{2x} - \frac{(\alpha_0-1)^2}{2\ ((\alpha_0-1)x - 2\alpha_0)}\right)B_S^{(3)}. \tag{8.38}$$

The initial conditions are the following. At $x = 0$, we have

$$B^{(1)}(x = 0, \epsilon; \alpha_0, d_1; \delta) = B^{(6)}(x = 0, \epsilon; \alpha_0, d_1; \delta) = B_{\alpha_0}(1 - 4\epsilon, 1 + 2d_1\epsilon)\, B(1 - \epsilon, 1 - \epsilon). \quad (8.39)$$

At $x = 1$, we have

$$\begin{aligned} B^{(5)}(x = 1, \epsilon; \alpha_0, d_1; \delta) &= B^{(1)}(x = 1, \epsilon; \alpha_0, d_1; \delta), \\ B^{(8)}(x = 1, \epsilon; \alpha_0, d_1; \delta) &= B^{(2)}(x = 1, \epsilon; \alpha_0, d_1; \delta), \\ B^{(9)}(x = 1, \epsilon; \alpha_0, d_1; \delta) &= B^{(3)}(x = 1, \epsilon; \alpha_0, d_1; \delta). \end{aligned} \quad (8.40)$$

At $x = 2$, we have

$$\begin{aligned} B^{(4)}(x = 2, \epsilon; \alpha_0, d_1; \delta) &= \frac{1}{2}\, B^{(1)}(x = 2, \epsilon; \alpha_0, d_1; \delta), \\ B^{(7)}(x = 2, \epsilon; \alpha_0, d_1; \delta) &= \frac{1}{2}\, B^{(3)}(x = 2, \epsilon; \alpha_0, d_1; \delta). \end{aligned} \quad (8.41)$$

It is easy to check that $B^{(1)}$ is finite at $x = 0$ and $x = 2$. The integration constants of $B^{(2)}$ and $B^{(3)}$ can then be fixed in an implicit way by requiring the residues of the general solution for $B^{(1)}$ to vanish at $x = 0$ and $x = 2$.

Having the analytic expression for the master integrals, we can calculate the $\mathcal{B}$-type integrals for a fixed integer value of D_0. We give the explicit results for $D_0 = 3$ in Appendix E.

In Fig. 5 we show some representative results of comparing the analytic and numeric computations for the ϵ^2 coefficient in the expansion of $\mathcal{I}(x, \epsilon; \alpha_0, 3 - 3\epsilon; 1, k, 1, g_{B_-})$ for $k = -1, 2$ and $\alpha_0 = 0.1, 1$. The dependence on α_0 is not visible on the plots. The two sets of results are in excellent agreement for the whole x-range. For other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters, we find similar agreement.

9. The soft $R \times (0)$-type $\mathcal{J}{*}\mathcal{I}$ integrals

In this section we calculate the integral defined in Eq. (3.31). Substituting the result for the angular integral $\Omega^{(1,1)}$, we can rewrite Eq. (3.31) as

$$\begin{aligned} \mathcal{J}{*}\mathcal{I}(Y, \epsilon; y_0, d_0', \alpha_0, d_0; k) = &-Y\, B(-\epsilon, -\epsilon)\, {}_2F_1(1, 1, 1 - \epsilon; 1 - Y) \\ &\times \int_0^{y_0} \mathrm{d}y\, y^{-1-2\epsilon}(1 - y)^{d_0'}\, \mathcal{I}(y; \epsilon, \alpha_0, d_0; 0, k, 0, g_A). \end{aligned} \quad (9.1)$$

The hypergeometric function can be easily evaluated using the technique described in Sect. 6. The evaluation of the y integral order by order in ϵ is a little bit more cumbersome because the integrand has two kinds of singularities,

1. The pole in $y = 0$.
2. The integral $\mathcal{I}$ is order by order logarithmically divergent for $y \sim 0$, as can be easily seen from the ϵ-expansion given in Appendix D.

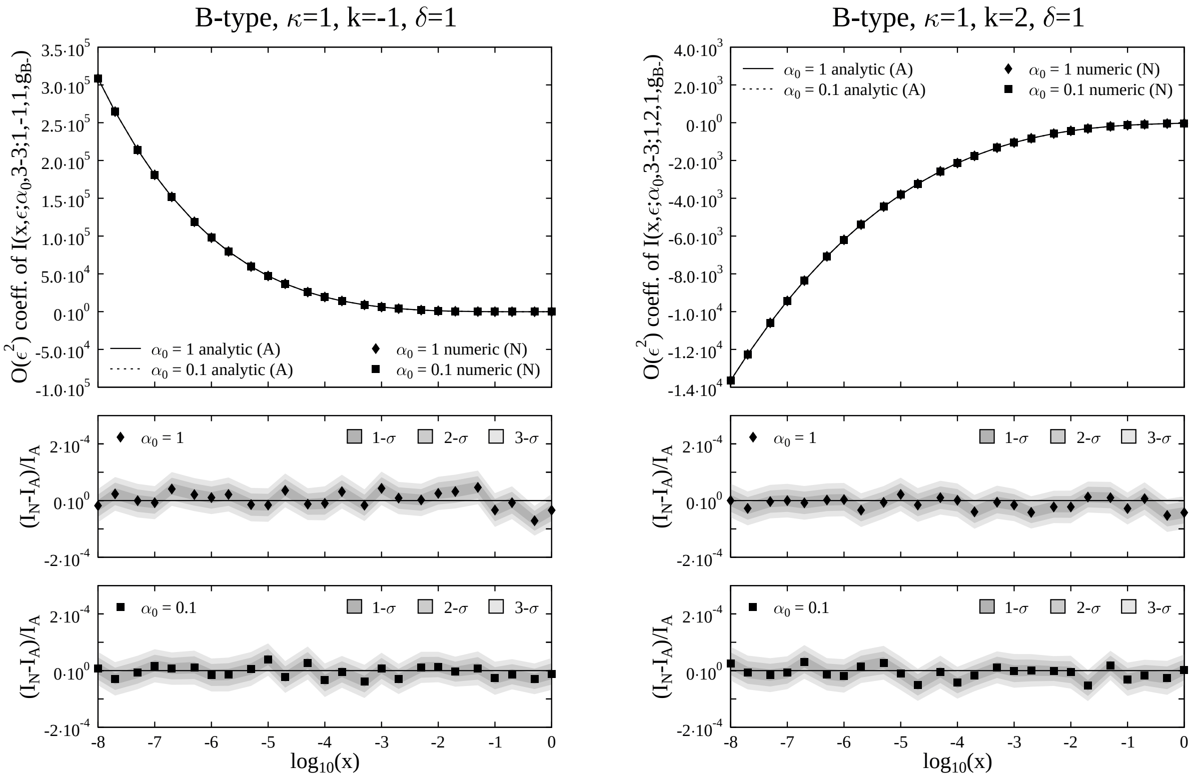

Figure 5: Representative results for the $\mathcal{B}$-type integrals. The plots show the coefficient of the $\mathrm{O}(\epsilon^2)$ term in $\mathcal{I}(x,\epsilon;\alpha_0,3-3\epsilon;1,k,1,g_{B_-})$ for $k=-1$ (left figure) and $k=2$ (right figure) with $\alpha_0=0.1,1$.

The pole in $y=0$ can easily be factorized by performing the integration by parts in y. The logarithmic singularities in $\mathcal{I}$ however are more subtle. We have to resum all these singularities before expanding the integral. We find that we can write[3]

$$\mathcal{I}(y;\epsilon,\alpha_0,d_0;0,k,0,g_A) = y^{-2\epsilon}\, I(y;\epsilon,\alpha_0,d_0;0,k,0,g_A), \tag{9.2}$$

where I is a function that is order by order finite in $y=0$. Eq. (9.1) can now be written as

$$\begin{aligned} \mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;k) = &-Y\,B(-\epsilon,-\epsilon)\,{}_2F_1(1,1,1-\epsilon;1-Y) \\ &\times\Bigg\{-\frac{1}{4\epsilon}\,y_0^{-4\epsilon}(1-y_0)^{d_0'}\,I(y_0;\epsilon,\alpha_0,d_0;0,k,0,g_A) \\ &+\frac{1}{4\epsilon}\int_0^{y_0}\mathrm{d}y\,y^{-4\epsilon}\frac{\partial}{\partial y}\Big[(1-y)^{d_0'}\,I(y;\epsilon,\alpha_0,d_0;0,k,0,g_A)\Big]\Bigg\}. \end{aligned} \tag{9.3}$$

As I does not have logarithmic divergences, the derivative does not produce any poles, and so the integral is uniformly convergent. We can thus just expand the integrand into a power series in ϵ and integrate order by order, using the definition of the *HPL's* [4], Eq. (4.2). The result for $D_0=D_0'=3$ is given in Appendix F.

[3]We checked this assumption explicitly on the ϵ-expansion of $\mathcal{I}$ given in Appendix D.

[4]Notice that the rational part of I gives a non-vanishing contribution to the lower integration limit that has to be subtracted.

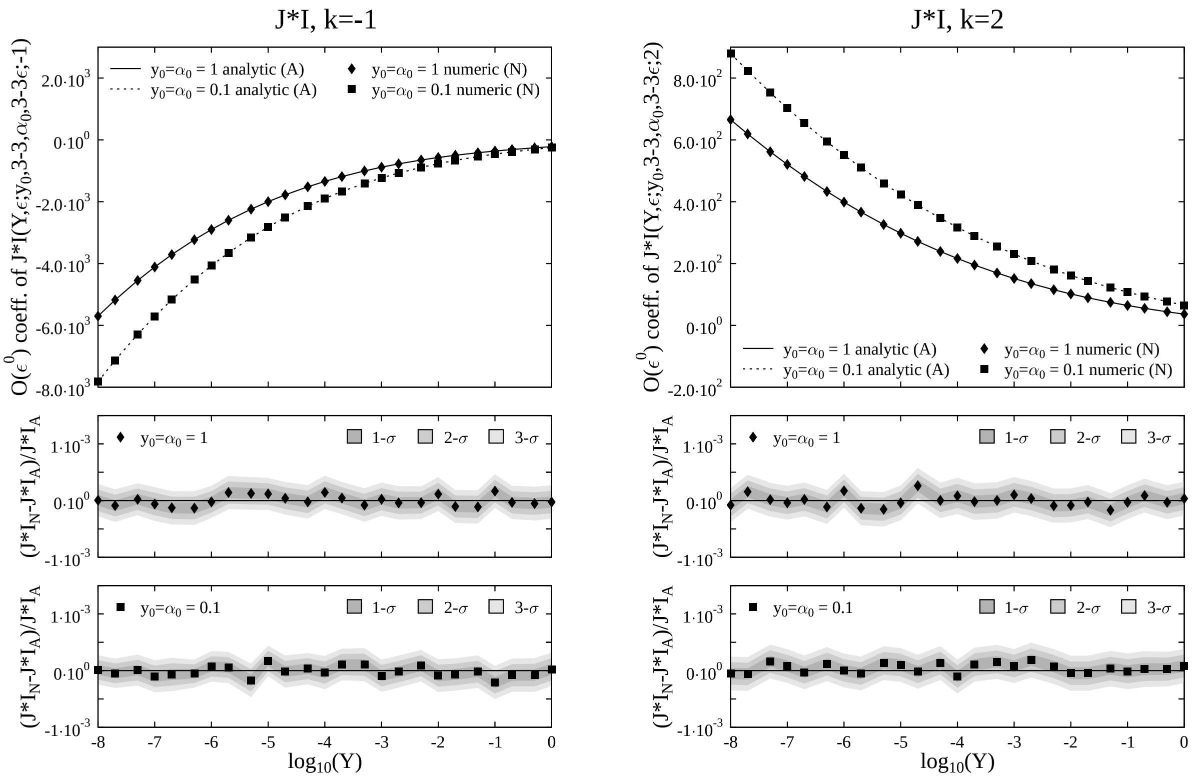

Figure 6: Representative results for the $\mathcal{J}{*}\mathcal{I}$ integrals. The plots show the coefficient of the $\mathrm{O}(\epsilon^0)$ term in $\mathcal{J}{*}\mathcal{I}(Y, \epsilon; y_0, 3-3\epsilon, \alpha_0, 3-3\epsilon; k)$ for $k=-1$ (left figure) and $k=2$ (right figure) with $y_0 = \alpha_0 = 0.1, 1$.

As representative examples, in Fig. 6 we compare the analytic and numeric results for the ϵ^0 coefficient in the expansion of $\mathcal{J}{*}\mathcal{I}(Y, \epsilon; y_0, 3-3\epsilon, \alpha_0, 3-3\epsilon; k)$ for $k=-1,2$ and $y_0 = \alpha_0 = 0.1, 1$. The two computations agree very well over the whole Y-range. Other (lower-order, thus simpler) expansion coefficients and/or other values of the parameters show similar agreement.

10. The soft-collinear $R \times (0)$-type $\mathcal{K}{*}\mathcal{I}$ integrals

In this section we calculate the integral defined in Eq. (3.32). The φ integral is given in Eq. (7.1). Putting $\cos\vartheta = 2\xi - 1$, the integral can be rewritten as

$$\begin{aligned}
&\mathcal{K}{*}\mathcal{I}(\epsilon; y_0, d_0', \alpha_0, d_0; k) = \\
&\qquad 2\,B(1-\epsilon, -\epsilon) \int_0^{y_0} \mathrm{d}y\, y^{-1-4\epsilon} (1-y)^{d_0'}\, I(y; \epsilon, \alpha_0, d_0; 0, k, 0, g_A) \\
&\qquad + 2\,B(1-\epsilon, 1-\epsilon) \int_0^{y_0} \mathrm{d}y\, y^{-4\epsilon} (1-y)^{d_0'-1}\, I(y; \epsilon, \alpha_0, d_0; 0, k, 0, g_A),
\end{aligned} \tag{10.1}$$

where I was defined in Eq. (9.2). The first integral is exactly the same as in Sect. 9. The second integral is uniformly convergent, so we can just expand under the integration sign, and integrate order by order. The result for $D_0 = D_0' = 3$ is given in Appendix G.

11. Numerical evaluation of integrated subtraction terms

Let us briefly discuss the numerical evaluation of the integrals which were analytically computed in the previous sections. First of all, if the singular integrals in the chosen integration variables are non-overlapping and furthermore occur in a single point in the integration region (which can always be mapped to the origin) then we can isolate the poles using standard residuum subtraction. Consider as an example the $\mathcal{K}(\epsilon; y_0, d_0'; \kappa)$ integral of Eq. (7.2):

$$\mathcal{K}(\epsilon; y_0, d_0'; \kappa) = 2\int_0^{y_0} \mathrm{d}y \int_0^1 \mathrm{d}\xi\; y^{-1-2(1+\kappa)\epsilon}(1-y)^{d_0'-1}\xi^{-\epsilon}(1-\xi)^{-1-(1+\kappa)\epsilon}(1-y\xi)^{1+\kappa\epsilon}. \quad (11.1)$$

We see that the singularities come only from $y \to 0$ and $\xi \to 1$ and there are no overlapping singularities[5]. After remapping the singularity at $\xi \to 1$ to the origin by setting $\xi \to 1-\xi$, we can easily extract the poles using residuum subtraction. The finite integrals that are left over are straightforward to evaluate numerically.

In general, we encounter integrals which contain overlapping divergences. A typical example occurs in the $\mathcal{A}$-type collinear integral for $k=-1$:

$$\begin{aligned} \mathcal{A}(x, \epsilon; \alpha_0, d_0; \kappa, -1) = & \int_0^{\alpha_0} \mathrm{d}\alpha \int_0^1 \mathrm{d}v\, \alpha^{-1-(1+\kappa)\epsilon}(1-\alpha)^{2d_0-1}[\alpha-(1-\alpha)x]^{-1-(1+\kappa)\epsilon} \\ & \times v^{-\epsilon}(1-v)^{-\epsilon}\,\frac{2\alpha+(1-\alpha)x}{\alpha+(1-\alpha)xv}\,. \end{aligned} \quad (11.2)$$

The singularities are at $\alpha \to 0$ and $v \to 0$, but the presence of the 'composite' denominator $\alpha+(1-\alpha)xv$ (which vanishes only when both $\alpha \to 0$ and $v \to 0$) does not allow the use of simple residuum subtraction to isolate the poles. Instead one has to disentangle the overlapping singularities first, which we achieve by using sector decomposition [31]. This consists of the following steps

- We first transform the integral so that the range of integration is the unit square. This is easily achieved by setting $\alpha \to \alpha_0\alpha$.
- Then we split the integral into two 'sectors' by inserting $1 = [\Theta(\alpha-v)+\Theta(v-\alpha)]$ in the integrand.
- Next, we transform the variables in each sector such that the integration region is remapped to the unit square. When $\alpha \ge v$, we use $v \to \alpha v$, while for $v \ge \alpha$ we need $\alpha \to v\alpha$.
- Notice that in each sector either α or v now factorizes from the composite denominator and the remainder is finite at $\alpha = 0, v = 0$.
- We can now apply residuum subtraction in each sector to extract the ϵ poles.

As before, the finite integrals left over are straightforward to compute numerically.

We have written a *Mathematica* package for the extraction of poles using these techniques. The program produces FORTRAN codes that may immediately be used in numerical integration

[5] Overlapping singularities would be signaled by the presence of 'composite' denominators, i.e. denominators which vanish only when *both* $y \to 0$ and $\xi \to 1$, but not otherwise.

programs. To produce the numerical results, we used the Monte Carlo integrator Vegas [32]. The program SectorDecomposition of Ref. [33] was used to check our implementation.

The main advantage of the numerical approach based on sector decomposition is its ability to handle a very wide class of integrals in a unified way. For example, the appearance of a new type of denominator in the integrals does not require any changes in the implementation of the algorithm. The drawbacks of the method stem from the fact that it does not give the expansion coefficients of the integrals directly. Rather it produces (usually very cumbersome) integral representations of them. Thus the evaluation of (any of) the integrated subtraction terms at any one point requires performing a numerical integration, which is time consuming and has an intrinsic numerical uncertainty. It might then be objected that this gives a slow and inaccurate[6] evaluation of the integrals. There is weight behind this objection, however let us note two things: first of all, the integrated subtraction terms can be computed once and for all. (At least for given values of α_0 and y_0. Changing these values requires the recomputation of all numerical integrals.) The final results are smooth functions and can be given e.g. in the form of interpolating tables. Second, in an actual computation, one expects that for any observable the relative uncertainty associated with the phase space integrations would be much greater than the relative uncertainty of the integrated subtraction terms. Therefore it can be argued that numerical results alone could be enough to produce physical higher-order computations.

Nevertheless, having analytical results is very useful for many purposes. First of all, in a higher-order computation, the ϵ poles of the integrated subtraction terms need to cancel the ϵ poles coming from the loop matrix elements in the virtual corrections. The correct cancellation of these poles can only be demonstrated rigorously once the pole structure of the integrated subtraction terms is exhibited analytically. With numerical results, one can only cancel the poles to whatever precision the numerical integrations were carried to. Second, in terms of speed and precision of evaluation, analytical results are very fast and very accurate compared to numerical ones. In fact, the analytical computation is only limited in this regard by the capability to compute *2dHPL's* in a fast and accurate way. Building a routine which accomplishes this task is not too difficult and has already been done in other cases [28]. It is feasible to construct an implementation that evaluates a *2dHPL* with a relative accuracy of $\mathcal{O}(10^{-15})$ in less than 1 millisecond on a standard PC. In the present context, the evaluation of the *2dHPL's* is further simplified by the fact that the arguments are always between zero and one, and the functions are all real in this range. There is then no need to worry about logarithms developing imaginary parts that have to be treated consistently. Finally, analytical results are 'user-friendly' in the sense that their use is not tied to any specific implementation or code. This is a particularly relevant concern when setting up a universal subtraction algorithm.

12. Conclusions

In this work we have analytically evaluated some of the integrals needed for computing the integrated real-virtual counterterms that appear in the subtraction scheme for computing NNLO jet cross sections proposed in Refs. [12, 13]. Such integrals have to be computed once and for all and their knowledge is necessary in order to make the subtraction scheme an effective tool. Our

[6]It certainly does not seem practical to obtain e.g. eight significant digits with this technique.

method is an adaptation of the current technique used to compute multi-loop Feynman diagrams: after an algebraic reduction to a class of independent amplitudes, integration-by-parts identities are generated and solved with the Laporta algorithm to achieve reduction to master integrals. The latter are computed with the differential equation method and are expressed in terms of one- and two-dimensional harmonic polylogarithms; the ϵ-expansion has been performed up to the required order in ϵ. The numerical evaluation of harmonic polylogarithms has been treated in many works, where it has been shown that it can be fast and accurate [25, 28]; there is not any specific problem in our case either. A check of all our analytic results has been made by means of a direct numerical calculation of the integrals, typically with an accuracy $\lesssim \mathcal{O}(10^{-4})$. Specific properties of the present calculation are:

1. the partial fractioning in many variables of the integrands, which requires in general the introduction of new denominators;
2. the occurrence of surface terms in integration-by-parts identities, consisting of integrals of lower dimensionality than the original ones;
3. a non-trivial basis extension for two-dimensional harmonic polylogarithms, together with corresponding consistency relations in order to have complete analytic control over the results.

Our method can in principle be applied to the analytic evaluation of classes of more complicated real-virtual integrated counter-terms, such as the C and D-type integrals of Sect. 8, even though the solution of the ibps in the latter case can be rather lengthy and the explicit expressions of the integrals can become rather cumbersome. For more complicated integrals, it is probably convenient to modify the algorithm used in this work in order to avoid the generation of additional denominators through the multiple partial fractioning. A preliminary study shows for example that our algorithm produces a lot of new denominators in the case of 3-dimensional integrals. For example, in reducing the integral over x and y considered in the introduction, one should not subject the "overlapping denominator" $1/(1 - xy)$ to any partial fractioning; this way one ends up with 3-denominator integrals without any additional denominator.

Acknowledgments

C.D. is a research fellow of the *Fonds National de la Recherche Scientifque*, Belgium. This work was partly supported by MIUR under contract $2006020509_0 04$, by the EC Marie-Curie Research Training Network "Tools and Precision Calculations for Physics Discoveries at Colliders" under contract MRTN-CT-2006-035505, by the Hungarian Scientific Research Fund grand OTKA K-60432 and by the Swiss National Science Foundation (SNF) under contract 200020-117602. We thank the Galileo Galilei Institute for Theoretical Physics and the "Laboratori Nazionali di Frascati" for the hospitality and the INFN for partial support during the completion of this work.

References

[1] S. Catani and M. H. Seymour, *A general algorithm for calculating jet cross sections in NLO QCD*, *Nucl. Phys.* **B485** (1997) 291–419, [hep-ph/9605323].

[2] A. Gehrmann-De Ridder, T. Gehrmann, and E. W. N. Glover, *Infrared structure of $e^+e^- \to 2$ jets at NNLO*, *Nucl. Phys.* **B691** (2004) 195–222, [hep-ph/0403057].

[3] A. Gehrmann-De Ridder, T. Gehrmann, and E. W. N. Glover, *Infrared structure of $e^+e^- \to 3$ jets at NNLO: The C_F^2 contribution*, *Nucl. Phys. Proc. Suppl.* **135** (2004) 97–101, [hep-ph/0407023].

[4] S. Weinzierl, *Subtraction terms at NNLO*, *JHEP* **03** (2003) 062, [hep-ph/0302180].

[5] S. Weinzierl, *Subtraction terms for one-loop amplitudes with one unresolved parton*, *JHEP* **07** (2003) 052, [hep-ph/0306248].

[6] S. Frixione and M. Grazzini, *Subtraction at NNLO*, *JHEP* **06** (2005) 010, [hep-ph/0411399].

[7] A. Gehrmann-De Ridder, T. Gehrmann, and E. W. N. Glover, *Quark-gluon antenna functions from neutralino decay*, *Phys. Lett.* **B612** (2005) 36–48, [hep-ph/0501291].

[8] A. Gehrmann-De Ridder, T. Gehrmann, and E. W. N. Glover, *Gluon gluon antenna functions from Higgs boson decay*, *Phys. Lett.* **B612** (2005) 49–60, [hep-ph/0502110].

[9] A. Gehrmann-De Ridder, T. Gehrmann, and E. W. N. Glover, *Antenna subtraction at NNLO*, *JHEP* **09** (2005) 056, [hep-ph/0505111].

[10] S. Weinzierl, *NNLO corrections to 2-jet observables in electron positron annihilation*, *Phys. Rev.* **D74** (2006) 014020, [hep-ph/0606008].

[11] G. Somogyi, Z. Trocsanyi, and V. Del Duca, *Matching of singly- and doubly-unresolved limits of tree-level QCD squared matrix elements*, *JHEP* **06** (2005) 024, [hep-ph/0502226].

[12] G. Somogyi, Z. Trocsanyi, and V. Del Duca, *A subtraction scheme for computing QCD jet cross sections at NNLO: Regularization of doubly-real emissions*, [hep-ph/0609042].

[13] G. Somogyi and Z. Trocsanyi, *A subtraction scheme for computing QCD jet cross sections at NNLO: Regularization of real-virtual emission*, [hep-ph/0609043].

[14] A. V. Kotikov, *Differential equations method: New technique for massive Feynman diagrams calculation*, *Phys. Lett.* **B254** (1991) 158–164.

[15] A. V. Kotikov, *Differential equations method: The Calculation of vertex type Feynman diagrams*, *Phys. Lett.* **B259** (1991) 314–322.

[16] A. V. Kotikov, *Differential equation method: The Calculation of N point Feynman diagrams*, *Phys. Lett.* **B267** (1991) 123–127.

[17] M. Caffo, H. Czyz, S. Laporta, and E. Remiddi, *The master differential equations for the 2-loop sunrise selfmass amplitudes*, *Nuovo Cim.* **A111** (1998) 365–389, [hep-th/9805118].

[18] M. Caffo, H. Czyz, S. Laporta, and E. Remiddi, *Master equations for master amplitudes*, *Acta Phys. Polon.* **B29** (1998) 2627–2635, [hep-th/9807119].

[19] E. Remiddi, *Differential equations for Feynman graph amplitudes*, *Nuovo Cim.* **A110** (1997) 1435–1452, [hep-th/9711188].

[20] E. Remiddi and J. A. M. Vermaseren, *Harmonic polylogarithms*, *Int. J. Mod. Phys.* **A15** (2000) 725–754, [hep-ph/9905237].

[21] T. Gehrmann and E. Remiddi, *Two-loop master integrals for $\gamma^* \to 3$ jets: The planar topologies*, *Nucl. Phys.* **B601** (2001) 248–286, [hep-ph/0008287].

[22] Z. Nagy, G. Somogyi, and Z. Trocsanyi, *Separation of soft and collinear infrared limits of QCD squared matrix elements*, [hep-ph/0702273].

[23] G. Somogyi and Z. Trocsanyi, *A new subtraction scheme for computing QCD jet cross sections at next-to-leading order accuracy*, [hep-ph/0609041].

[24] G. Somogyi and Z. Trocsanyi, *A subtraction scheme for computing QCD jet cross sections at NNLO: integrating the subtraction terms I*, [[hep-ph] 0807.0509].

[25] T. Gehrmann and E. Remiddi, *Numerical evaluation of harmonic polylogarithms*, *Comput. Phys. Commun.* **141** (2001) 296–312, [hep-ph/0107173].

[26] D. Maitre, *HPL, a mathematica implementation of the harmonic polylogarithms*, *Comput. Phys. Commun.* **174** (2006) 222–240, [hep-ph/0507152].

[27] D. Maitre, *Extension of HPL to complex arguments*, [hep-ph/0703052].

[28] T. Gehrmann and E. Remiddi, *Numerical evaluation of two-dimensional harmonic polylogarithms*, *Comput. Phys. Commun.* **144** (2002) 200–223, [hep-ph/0111255].

[29] W. L. van Neerven, *Dimensional regularization of mass and infrared singularities in two loop on-shell vertex functions*, *Nucl. Phys.* **B286** (1986) 453.

[30] T. Huber and D. Maitre, *HypExp, a Mathematica package for expanding hypergeometric functions around integer-valued parameters*, *Comput. Phys. Commun.* **175** (2006) 122–144, [hep-ph/0507094].

[31] G. Heinrich, *Sector Decomposition*, *Int. J. Mod. Phys. A* **23** (2008) 1457, [[hep-ph] 0803.4177], and references therein.

[32] G. P. Lepage, *Vegas: An Adaptive Multidimensional Integration Program*, *CLNS-80/447* (1980).

[33] C. Bogner and S. Weinzierl, *Resolution of singularities for multi-loop integrals*, *Comput. Phys. Commun.* **178** (2008) 596, [[hep-ph] 0709.4092].

A. Spin-averaged splitting kernels

In this Appendix we recall the explicit expressions for the spin-averaged splitting kernels that enter Eq. (3.11).

The azimuthally averaged Altarelli–Parisi splitting kernels read

$$P^{(0)}_{g_i g_r}(z_i, z_r; \epsilon) = 2C_{\mathrm{A}} \left[\frac{1}{z_i} + \frac{1}{z_r} - 2 + z_i z_r \right] , \tag{A.1}$$

$$P^{(0)}_{q_i \bar{q}_r}(z_i, z_r; \epsilon) = T_{\mathrm{R}} \left[1 - \frac{2}{1-\epsilon} z_i z_r \right] , \tag{A.2}$$

$$P^{(0)}_{q_i g_r}(z_i, z_r; \epsilon) = C_{\mathrm{F}} \left[\frac{2}{z_r} - 2 + (1-\epsilon) z_r \right] , \tag{A.3}$$

while their one-loop generalizations are

$$P^{(1)}_{f_i f_r}(z_i, z_r; \epsilon) = r^{f_i f_r}_{\mathrm{S,ren}}(z_i, z_r; \epsilon) P^{(0)}_{f_i f_r}(z_i, z_r; \epsilon) + \begin{cases} 2C_{\mathrm{A}}\, r^{gg}_{\mathrm{N.S.}} \dfrac{1 - 2\epsilon z_i z_r}{1-\epsilon} , & \text{if} \quad f_i f_r = gg , \\ 0 , & \text{if} \quad f_i f_r = q\bar{q} , \\ C_{\mathrm{F}}\, r^{qg}_{\mathrm{N.S.}} \,(1 - \epsilon z_r) , & \text{if} \quad f_i f_r = qg . \end{cases} \tag{A.4}$$

The renormalized $r^{f_i f_r}_{\mathrm{S,ren}}(z_i, z_r; \epsilon)$ functions that appear above are expressed in terms of the corresponding unrenormalized ones as

$$r^{f_i f_r}_{\mathrm{S,ren}}(z_i, z_r; \epsilon) = r^{f_i f_r}_{\mathrm{S}}(z_i, z_r; \epsilon) - \frac{\beta_0}{2\epsilon} \frac{S_\epsilon}{(4\pi)^2 c_\Gamma} \left[\left(\frac{\mu^2}{s_{ir}} \right)^{\epsilon} \cos(\pi\epsilon) \right]^{-1} , \tag{A.5}$$

where the unrenormalized $r^{f_i f_r}_{\mathrm{S}}(z_i, z_r; \epsilon)$ factors may be written in the following form

$$\begin{aligned} r^{gg}_{\mathrm{S}}(z_i, z_r; \epsilon) = \frac{C_{\mathrm{A}}}{\epsilon^2} \Bigg[&- \frac{\pi\epsilon}{\sin(\pi\epsilon)} \left(\frac{z_i}{z_r} \right)^{\epsilon} + z_i^{\epsilon}\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_r) \\ &- z_i^{-\epsilon}\, {}_2F_1(-\epsilon, -\epsilon, 1-\epsilon, z_r) \Bigg] , \end{aligned} \tag{A.6}$$

$$\begin{aligned} r^{q\bar{q}}_{\mathrm{S}}(z_i, z_r; \epsilon) = \frac{1}{\epsilon^2}(C_{\mathrm{A}} - 2C_{\mathrm{F}}) + \frac{C_{\mathrm{A}}}{\epsilon^2} \Bigg[&- \frac{\pi\epsilon}{\sin(\pi\epsilon)} \left(\frac{z_i}{z_r} \right)^{\epsilon} + z_i^{\epsilon}\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_r) \\ &- \frac{\pi\epsilon}{\sin(\pi\epsilon)} \left(\frac{z_r}{z_i} \right)^{\epsilon} + z_r^{\epsilon}\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_i) \Bigg] \\ + \frac{1}{1-2\epsilon} \Bigg[&\frac{\beta_0 - 3C_{\mathrm{F}}}{\epsilon} + C_{\mathrm{A}} - 2C_{\mathrm{F}} + \frac{C_{\mathrm{A}} + 4T_{\mathrm{R}}(n_{\mathrm{f}} - n_{\mathrm{s}})}{3(3-2\epsilon)} \Bigg] , \end{aligned} \tag{A.7}$$

$$\begin{aligned} r^{qg}_{\mathrm{S}}(z_i, z_r; \epsilon) = -\frac{1}{\epsilon^2} \Bigg[&2(C_{\mathrm{A}} - C_{\mathrm{F}}) + C_{\mathrm{A}} \frac{\pi\epsilon}{\sin(\pi\epsilon)} \left(\frac{z_i}{z_r} \right)^{\epsilon} - C_{\mathrm{A}} z_i^{\epsilon}\, {}_2F_1(\epsilon, \epsilon, 1+\epsilon, z_r) \\ &- (C_{\mathrm{A}} - 2C_{\mathrm{F}}) z_i^{-\epsilon}\, {}_2F_1(-\epsilon, -\epsilon, 1-\epsilon, z_r) \Bigg] . \end{aligned} \tag{A.8}$$

The $r^{f_i f_r}_{\mathrm{N.S.}}$ non-singular factors are

$$r^{gg}_{\mathrm{N.S.}} = \frac{C_{\mathrm{A}}(1-\epsilon) - 2T_{\mathrm{R}}(n_{\mathrm{f}} - n_{\mathrm{s}})}{(1-2\epsilon)(2-2\epsilon)(3-2\epsilon)} , \qquad r^{qg}_{\mathrm{N.S.}} = \frac{C_{\mathrm{A}} - C_{\mathrm{F}}}{1-2\epsilon} . \tag{A.9}$$

For QCD, $n_{\mathrm{s}} = 0$. Finally β_0 in Eqs. (A.5) and (A.7) is given by

$$\beta_0 = \frac{11}{3} C_{\mathrm{A}} - \frac{4}{3} T_{\mathrm{R}} n_{\mathrm{f}} - \frac{2}{3} T_{\mathrm{R}} n_{\mathrm{s}} . \tag{A.10}$$

B. The $\mathcal{J}$ integrals

The ε expansion for this integral reads

$$\mathcal{J}(Y,\varepsilon;y_0,3+d_1'\varepsilon;\kappa)=\frac{1}{\varepsilon^2}i_{-2}^{(\kappa)}+\frac{1}{\varepsilon}i_{-1}^{(\kappa)}+i_0+\varepsilon i_1^{(\kappa)}+\varepsilon^2 i_2^{(\kappa)}+\mathcal{O}\left(\varepsilon^3\right), \tag{B.1}$$

where

$$i_{-2}^{(\kappa)}=-\frac{1}{(\kappa+1)^2},$$

$$i_{-1}^{(\kappa)}=-\frac{2y_0^3}{3(\kappa+1)}+\frac{3y_0^2}{\kappa+1}-\frac{6\,y_0}{\kappa+1}+\frac{2H(0;y_0)}{\kappa+1}+\frac{H(0;Y)}{\kappa+1},$$

$$i_0^{(\kappa)}=\frac{2d_1'y_0^3}{9(3\kappa+1)}+\frac{2d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{8\kappa y_0^3}{9(3\kappa+1)}-\frac{4y_0^3}{9(3\kappa+1)}-\frac{7d_1'y_0^2}{6(3\kappa+1)}-\frac{7d_1'\kappa y_0^2}{6(3\kappa+1)}+\frac{20\kappa y_0^2}{3(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}+\frac{11d_1'y_0}{3(3\kappa+1)}+\frac{11d_1'\kappa y_0}{3(3\kappa+1)}-\frac{86\kappa y_0}{3(3\kappa+1)}-\frac{12y_0}{3\kappa+1}+\left(\frac{4y_0^3}{3}-6\,y_0^2+12y_0\right)H(0;y_0)+\left(\frac{2y_0^3}{3}-3y_0^2+6y_0-2\,H(0;y_0)\right)H(0;Y)+\left(\frac{2d_1'y_0^3}{3(3\kappa+1)}+\frac{2d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{4\kappa\,y_0^3}{3(3\kappa+1)}-\frac{3d_1'y_0^2}{3\kappa+1}-\frac{3d_1'\,\kappa y_0^2}{3\kappa+1}-\frac{6\kappa y_0^2}{3\kappa+1}+\frac{6d_1'y_0}{3\kappa+1}+\frac{6d_1'\kappa y_0}{3\kappa+1}+\frac{12\kappa y_0}{3\kappa+1}-\frac{11d_1'}{3(3\kappa+1)}-\frac{11d_1'\kappa}{3(3\kappa+1)}-\frac{22\kappa}{3(3\kappa+1)}\right)H(1;y_0)-4H(0,0;y_0)-H(0,0;Y)+\left(-\frac{2\kappa\,d_1'}{(\kappa+1)^2}-\frac{2d_1'}{(\kappa+1)^2}-\frac{4\kappa}{(\kappa+1)^2}\right)H(0,1;y_0)-H(1,0;Y),$$

$$i_1^{(\kappa)}=-\frac{2d_1'^2y_0^3}{27(3\kappa+1)}+\frac{8d_1'y_0^3}{27(3\kappa+1)}-\frac{2d_1'^2\kappa y_0^3}{27(3\kappa+1)}+\frac{16\,d_1'\kappa y_0^3}{27(3\kappa+1)}-\frac{28\kappa y_0^3}{27(3\kappa+1)}-\frac{8y_0^3}{27(3\kappa+1)}+\frac{17d_1'^2\,y_0^2}{36(3\kappa+1)}-\frac{22d_1'y_0^2}{9(3\kappa+1)}+\frac{17d_1'^2\kappa y_0^2}{36(3\kappa+1)}-\frac{49d_1'\,\kappa y_0^2}{9(3\kappa+1)}+\frac{73\kappa y_0^2}{6(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}-\frac{49d_1'^2y_0}{18(3\kappa+1)}+\frac{151d_1'y_0}{9(3\kappa+1)}-\frac{49d_1'^2\kappa\,y_0}{18(3\kappa+1)}+\frac{355d_1'\kappa y_0}{9(3\kappa+1)}-\frac{319\kappa y_0}{3(3\kappa+1)}-\frac{24y_0}{3\kappa+1}+\left(-\frac{4d_1'y_0^3}{9(3\kappa+1)}-\frac{4d_1'\kappa\,y_0^3}{3(3\kappa+1)}+\frac{40\kappa y_0^3}{9(3\kappa+1)}+\frac{8y_0^3}{9(3\kappa+1)}+\frac{7d_1'y_0^2}{3(3\kappa+1)}+\frac{7d_1'\kappa y_0^2}{3\kappa+1}-\frac{98\kappa\,y_0^2}{3(3\kappa+1)}-\frac{6y_0^2}{3\kappa+1}-\frac{22d_1'\,y_0}{3(3\kappa+1)}-\frac{22d_1'\kappa y_0}{3\kappa+1}+\frac{416\kappa y_0}{3(3\kappa+1)}+\frac{24y_0}{3\kappa+1}\right)H(0;y_0)+\left(-\frac{2d_1'^2y_0^3}{9(3\kappa+1)}+\frac{4d_1'y_0^3}{9(3\kappa+1)}-\frac{2d_1'^2\kappa\,y_0^3}{9(3\kappa+1)}+\frac{4d_1'\kappa y_0^3}{9(3\kappa+1)}+\frac{4\kappa y_0^3}{3(3\kappa+1)}+\frac{7d_1'^2y_0^2}{6(3\kappa+1)}-\frac{3d_1'y_0^2}{3\kappa+1}+\frac{7d_1'^2\kappa\,y_0^2}{6(3\kappa+1)}-\frac{13d_1'\kappa y_0^2}{3(3\kappa+1)}-\frac{29\kappa y_0^2}{3(3\kappa+1)}-\frac{11d_1'^2y_0}{3(3\kappa+1)}+\frac{12d_1'y_0}{3\kappa+1}-\frac{11d_1'^2\kappa\,y_0}{3(3\kappa+1)}+\frac{64d_1'\kappa y_0}{3(3\kappa+1)}+\frac{122\kappa y_0}{3(3\kappa+1)}+\frac{49d_1'^2}{18(3\kappa+1)}-\frac{85d_1'}{9(3\kappa+1)}+\frac{49d_1'^2\kappa}{18(3\kappa+1)}-\frac{157d_1'\kappa}{9(3\kappa+1)}-\frac{97\,\kappa}{3(3\kappa+1)}\right)H(1;y_0)+\frac{1}{6}\pi^2\,H(1;Y)+\left(-\frac{56\kappa y_0^3}{3(3\kappa+1)}-\frac{8\,y_0^3}{3(3\kappa+1)}+\frac{84\kappa y_0^2}{3\kappa+1}+\frac{12\,y_0^2}{3\kappa+1}-\frac{168\kappa y_0}{3\kappa+1}-\frac{24\,y_0}{3\kappa+1}\right)H(0,0;y_0)+\left(-\frac{14\kappa y_0^3}{3(3\kappa+1)}-\frac{2y_0^3}{3(3\kappa+1)}+\frac{21\kappa y_0^2}{3\kappa+1}+\frac{3y_0^2}{3\kappa+1}-\frac{42\kappa y_0}{3\kappa+1}-\frac{6y_0}{3\kappa+1}+\left(\frac{14\kappa}{(\kappa+1)^2}+\frac{2}{(\kappa+1)^2}\right)H(0;y_0)\right)\,H(0,0;Y)+\left(-\frac{4d_1'y_0^3}{3(3\kappa+1)}-\frac{4d_1'\,\kappa y_0^3}{3\kappa+1}-\frac{16\kappa y_0^3}{3(3\kappa+1)}+\frac{6d_1'y_0^2}{3\kappa+1}+\frac{18d_1'\kappa y_0^2}{3\kappa+1}+\frac{24\kappa y_0^2}{3\kappa+1}-\frac{12d_1'y_0}{3\kappa+1}-\frac{36d_1'\kappa y_0}{3\kappa+1}-\frac{48\kappa\,y_0}{3\kappa+1}\right)H(0,1;y_0)+H(0;Y)\left(-\frac{2d_1'y_0^3}{9(3\kappa+1)}-\frac{2d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{20\,\kappa y_0^3}{9(3\kappa+1)}+\frac{4y_0^3}{9(3\kappa+1)}+\frac{7d_1'y_0^2}{6(3\kappa+1)}+\frac{7d_1'\kappa\,y_0^2}{2(3\kappa+1)}-\frac{49\kappa y_0^2}{3(3\kappa+1)}-\frac{3y_0^2}{3\kappa+1}-\frac{11d_1'y_0}{3(3\kappa+1)}-\frac{11d_1'\kappa y_0}{3\kappa+1}+\frac{208\kappa y_0}{3(3\kappa+1)}+\frac{12y_0}{3\kappa+1}+\left(-\frac{28\kappa\,y_0^3}{3(3\kappa+1)}-\frac{4y_0^3}{3(3\kappa+1)}+\frac{42\,\kappa y_0^2}{3\kappa+1}+\frac{6y_0^2}{3\kappa+1}-\frac{84\,\kappa y_0}{3\kappa+1}-\frac{12y_0}{3\kappa+1}\right)\,H(0;y_0)+\left(-\frac{2d_1'y_0^3}{3(3\kappa+1)}-\frac{2d_1'\,\kappa y_0^3}{3\kappa+1}-\frac{8\kappa y_0^3}{3(3\kappa+1)}+\frac{3d_1'y_0^2}{3\kappa+1}+\frac{9d_1'\kappa y_0^2}{3\kappa+1}+\frac{12\kappa y_0^2}{3\kappa+1}-\frac{6d_1'y_0}{3\kappa+1}-\frac{18d_1'\kappa y_0}{3\kappa+1}-\frac{24\kappa\,y_0}{3\kappa+1}+\frac{11d_1'}{3(3\kappa+1)}+\frac{11d_1'\,\kappa}{3\kappa+1}+\frac{44\kappa}{3(3\kappa+1)}\right)\,H(1;y_0)+\left(\frac{28\kappa}{(\kappa+1)^2}+\frac{4}{(\kappa+1)^2}\right)H(0,0;y_0)+\left(\frac{6\kappa d_1'}{(\kappa+1)^2}+\frac{2d_1'}{(\kappa+1)^2}+\frac{8\kappa}{(\kappa+1)^2}\right)H(0,1;y_0)\right)+\left(-\frac{4d_1'y_0^3}{3(3\kappa+1)}-\frac{4d_1'\kappa y_0^3}{3\kappa+1}-\frac{16\kappa\,y_0^3}{3(3\kappa+1)}+\frac{6d_1'y_0^2}{3\kappa+1}+\frac{18\,d_1'\kappa y_0^2}{3\kappa+1}+\frac{24\kappa y_0^2}{3\kappa+1}-\frac{12d_1'y_0}{3\kappa+1}-\frac{36d_1'\kappa y_0}{3\kappa+1}-\frac{48\kappa y_0}{3\kappa+1}+\frac{22d_1'}{3(3\kappa+1)}+\frac{22d_1'\kappa}{3\kappa+1}+\frac{88\kappa}{3(3\kappa+1)}\right)H(1,0;y_0)+\left(-\frac{14\kappa y_0^3}{3(3\kappa+1)}-\frac{2y_0^3}{3(3\kappa+1)}+\frac{21\kappa y_0^2}{3\kappa+1}+\frac{3y_0^2}{3\kappa+1}-\frac{42\kappa y_0}{3\kappa+1}-\frac{6y_0}{3\kappa+1}+\left(\frac{14\kappa}{(\kappa+1)^2}+\frac{2}{(\kappa+1)^2}\right)H(0;y_0)\right)\,H(1,0;Y)+\left(-\frac{2d_1'^2y_0^3}{3(3\kappa+1)}-\frac{2d_1'^2\,\kappa y_0^3}{3(3\kappa+1)}-\frac{8d_1'\kappa y_0^3}{3(3\kappa+1)}-\frac{4\kappa y_0^3}{3(3\kappa+1)}+\frac{3d_1'^2\,y_0^2}{3\kappa+1}+\frac{3d_1'^2\kappa y_0^2}{3\kappa+1}+\frac{12d_1'\kappa y_0^2}{3\kappa+1}+\frac{6\kappa\,y_0^2}{3\kappa+1}-\frac{6d_1'^2y_0}{3\kappa+1}-\frac{6d_1'^2\,\kappa y_0}{3\kappa+1}-\frac{24d_1'\kappa y_0}{3\kappa+1}-\frac{12\kappa y_0}{3\kappa+1}+\frac{11d_1'^2}{3(3\kappa+1)}+\frac{11d_1'^2\kappa}{3(3\kappa+1)}+\frac{44d_1'\kappa}{3(3\kappa+1)}+\frac{22\kappa}{3(3\kappa+1)}\right)\,H(1,1;y_0)+\left(\frac{56\kappa}{(\kappa+1)^2}+\frac{8}{(\kappa+1)^2}\right)H(0,0,0;y_0)+\left(\frac{7\kappa}{(\kappa+1)^2}+\frac{1}{(\kappa+1)^2}\right)H(0,0,0;Y)+\left(\frac{12\kappa\,d_1'}{(\kappa+1)^2}+\frac{4d_1'}{(\kappa+1)^2}+\frac{16\kappa}{(\kappa+1)^2}\right)H(0,0,1;y_0)+\left(\frac{12\kappa d_1'}{(\kappa+1)^2}+\frac{4d_1'}{(\kappa+1)^2}+\frac{16\kappa}{(\kappa+1)^2}\right)H(0,1,0;y_0)+\left(\frac{7\kappa}{(\kappa+1)^2}+\frac{1}{(\kappa+1)^2}\right)H(0,1,0;Y)+\left(\frac{2\kappa\,d_1'^2}{(\kappa+1)^2}+\frac{2d_1'^2}{(\kappa+1)^2}+\frac{8\kappa\,d_1'}{(\kappa+1)^2}+\frac{4\kappa}{(\kappa+1)^2}\right)\,H(0,1,1;y_0)+H(1,0,0;Y)+H(1,1,0;Y)+\frac{22\kappa\zeta_3}{3\kappa+1}+\frac{2\zeta_3}{3\kappa+1},$$

$$i_2^{(\kappa)} =$$

$$\frac{2\kappa y_0^3 d_1'^3}{81(3\kappa+1)}+\frac{2y_0^3 d_1'^3}{81(3\kappa+1)}-\frac{43\kappa y_0^2 d_1'^3}{216(3\kappa+1)}-\frac{43y_0^2 d_1'^3}{216(3\kappa+1)}+\frac{251\kappa y_0 d_1'^3}{108(3\kappa+1)}+\frac{251 y_0 d_1'^3}{108(3\kappa+1)}-\frac{8\kappa y_0^3 d_1'^2}{27(3\kappa+1)}-\frac{4y_0^3 d_1'^2}{27(3\kappa+1)}+\frac{31\kappa y_0^2 d_1'^2}{9(3\kappa+1)}+$$

$$\frac{167y_0^2 d_1'^2}{108(3\kappa+1)}-\frac{833\kappa y_0 d_1'^2}{18(3\kappa+1)}-\frac{542 y_0 d_1'^2}{27(3\kappa+1)}+\frac{28\kappa y_0^3 d_1'}{27(3\kappa+1)}+\frac{8y_0^3 d_1'}{27(3\kappa+1)}-\frac{1663\kappa y_0^2 d_1'}{108(3\kappa+1)}-\frac{205y_0^2 d_1'}{54(3\kappa+1)}+\frac{12815\kappa y_0 d_1'}{54(3\kappa+1)}+\frac{1481 y_0 d_1'}{27(3\kappa+1)}-$$

$$\frac{92\kappa y_0^3}{81(3\kappa+1)}-\frac{16y_0^3}{81(3\kappa+1)}+\frac{245\kappa y_0^2}{12(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}-\frac{2141\kappa y_0}{6(3\kappa+1)}-\frac{48y_0}{3\kappa+1}+\Bigg(\frac{2\kappa y_0^3 d_1'^3}{27(3\kappa+1)}+\frac{2y_0^3 d_1'^3}{27(3\kappa+1)}-\frac{17\kappa y_0^2 d_1'^3}{36(3\kappa+1)}-\frac{17y_0^2 d_1'^3}{36(3\kappa+1)}+$$

$$\frac{49\kappa y_0 d_1'^3}{18(3\kappa+1)}+\frac{49y_0 d_1'^3}{18(3\kappa+1)}-\frac{251\kappa d_1'^3}{108(3\kappa+1)}-\frac{251 d_1'^3}{108(3\kappa+1)}-\frac{4\kappa y_0^3 d_1'^2}{9(3\kappa+1)}-\frac{8y_0^3 d_1'^2}{27(3\kappa+1)}+\frac{9\kappa y_0^2 d_1'^2}{2(3\kappa+1)}+\frac{22y_0^2 d_1'^2}{9(3\kappa+1)}-\frac{34\kappa y_0 d_1'^2}{3\kappa+1}-$$

$$\frac{151 y_0 d_1'^2}{9(3\kappa+1)}+\frac{539\kappa d_1'^2}{18(3\kappa+1)}+\frac{395 d_1'^2}{27(3\kappa+1)}+\frac{4\kappa y_0^3 d_1'}{27(3\kappa+1)}+\frac{8y_0^3 d_1'}{27(3\kappa+1)}-\frac{77\kappa y_0^2 d_1'}{18(3\kappa+1)}-\frac{3y_0^2 d_1'}{3\kappa+1}+\frac{451\kappa y_0 d_1'}{9(3\kappa+1)}+\frac{24 y_0 d_1'}{3\kappa+1}-\frac{2483\kappa d_1'}{54(3\kappa+1)}-$$

$$\frac{575 d_1'}{27(3\kappa+1)}+\frac{4\kappa y_0^3}{3(3\kappa+1)}-\frac{91\kappa y_0^2}{6(3\kappa+1)}+\frac{391\kappa y_0}{3(3\kappa+1)}-\frac{233\kappa}{2(3\kappa+1)}\Bigg)H(1;y_0)+\Bigg(\frac{8d_1' y_0^3}{9(3\kappa+1)}+\frac{56 d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{176\kappa y_0^3}{9(3\kappa+1)}-\frac{16y_0^3}{9(3\kappa+1)}-$$

$$\frac{14 d_1' y_0^2}{3(3\kappa+1)}-\frac{98 d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{428\kappa y_0^2}{3(3\kappa+1)}+\frac{12y_0^2}{3\kappa+1}+\frac{44 d_1' y_0}{3(3\kappa+1)}+\frac{308 d_1'\kappa y_0}{3(3\kappa+1)}-\frac{1808\kappa y_0}{3(3\kappa+1)}-\frac{48y_0}{3\kappa+1}\Bigg)H(0,0;y_0)+\Bigg(\frac{4d_1'^2 y_0^3}{9(3\kappa+1)}-$$

$$\frac{8d_1' y_0^3}{9(3\kappa+1)}+\frac{4d_1'^2\kappa y_0^3}{3(3\kappa+1)}-\frac{8d_1'\kappa y_0^3}{3(3\kappa+1)}-\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{7d_1'^2 y_0^2}{3(3\kappa+1)}+\frac{6d_1' y_0^2}{3\kappa+1}-\frac{7d_1'^2\kappa y_0^2}{3\kappa+1}+\frac{70 d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{116\kappa y_0^2}{3(3\kappa+1)}+\frac{22 d_1'^2 y_0}{3(3\kappa+1)}-\frac{24 d_1' y_0}{3\kappa+1}+$$

$$\frac{22 d_1'^2\kappa y_0}{3\kappa+1}-\frac{328 d_1'\kappa y_0}{3(3\kappa+1)}-\frac{488\kappa y_0}{3(3\kappa+1)}\Bigg)H(0,1;y_0)+H(0,0;Y)\Bigg(\frac{2d_1' y_0^3}{9(3\kappa+1)}+\frac{14 d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{44\kappa y_0^3}{9(3\kappa+1)}-\frac{4y_0^3}{9(3\kappa+1)}-\frac{7d_1' y_0^2}{6(3\kappa+1)}-$$

$$\frac{49 d_1'\kappa y_0^2}{6(3\kappa+1)}+\frac{107\kappa y_0^2}{3(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}+\frac{11 d_1' y_0}{3(3\kappa+1)}+\frac{77 d_1'\kappa y_0}{3(3\kappa+1)}-\frac{452\kappa y_0}{3(3\kappa+1)}-\frac{12y_0}{3\kappa+1}+\Bigg(\frac{20\kappa y_0^3}{3\kappa+1}+\frac{4y_0^3}{3(3\kappa+1)}-\frac{90\kappa y_0^2}{3\kappa+1}-\frac{6y_0^2}{3\kappa+1}+$$

$$\frac{180\kappa y_0}{3\kappa+1}+\frac{12y_0}{3\kappa+1}\Bigg)H(0;y_0)+\Bigg(\frac{2d_1' y_0^3}{3(3\kappa+1)}+\frac{14 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{3d_1' y_0^2}{3\kappa+1}-\frac{21 d_1'\kappa y_0^2}{3\kappa+1}-\frac{24\kappa y_0^2}{3\kappa+1}+\frac{6d_1' y_0}{3\kappa+1}+\frac{42 d_1'\kappa y_0}{3\kappa+1}+$$

$$\frac{48\kappa y_0}{3\kappa+1}-\frac{11 d_1'}{3(3\kappa+1)}-\frac{77 d_1'\kappa}{3(3\kappa+1)}-\frac{88\kappa}{3(3\kappa+1)}\Bigg)H(1;y_0)+\Bigg(-\frac{60\kappa}{(\kappa+1)^2}-\frac{4}{(\kappa+1)^2}\Bigg)H(0,0;y_0)+\Bigg(-\frac{14\kappa d_1'}{(\kappa+1)^2}-\frac{2d_1'}{(\kappa+1)^2}-$$

$$\frac{16\kappa}{(\kappa+1)^2}\Bigg)H(0,1;y_0)\Bigg)+\Bigg(-\frac{7\pi^2\kappa}{6(3\kappa+1)}-\frac{\pi^2}{6(3\kappa+1)}\Bigg)H(0,1;Y)+\Bigg(\frac{4d_1'^2 y_0^3}{9(3\kappa+1)}-\frac{8d_1' y_0^3}{9(3\kappa+1)}+\frac{4d_1'^2\kappa y_0^3}{3(3\kappa+1)}-\frac{8d_1'\kappa y_0^3}{3(3\kappa+1)}-$$

$$\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{7d_1'^2 y_0^2}{3(3\kappa+1)}+\frac{6d_1' y_0^2}{3\kappa+1}-\frac{7d_1'^2\kappa y_0^2}{3\kappa+1}+\frac{70 d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{116\kappa y_0^2}{3(3\kappa+1)}+\frac{22 d_1'^2 y_0}{3(3\kappa+1)}-\frac{24 d_1' y_0}{3\kappa+1}+\frac{22 d_1'^2\kappa y_0}{3\kappa+1}-\frac{328 d_1'\kappa y_0}{3(3\kappa+1)}-$$

$$\frac{488\kappa y_0}{3(3\kappa+1)}-\frac{49 d_1'^2}{9(3\kappa+1)}+\frac{170 d_1'}{9(3\kappa+1)}-\frac{49 d_1'^2\kappa}{3(3\kappa+1)}+\frac{266 d_1'\kappa}{3(3\kappa+1)}+\frac{388\kappa}{3(3\kappa+1)}\Bigg)H(1,0;y_0)+\Bigg(\frac{2d_1' y_0^3}{9(3\kappa+1)}+\frac{14 d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{44\kappa y_0^3}{9(3\kappa+1)}-$$

$$\frac{4y_0^3}{9(3\kappa+1)}-\frac{7d_1' y_0^2}{6(3\kappa+1)}-\frac{49 d_1'\kappa y_0^2}{6(3\kappa+1)}+\frac{107\kappa y_0^2}{3(3\kappa+1)}+\frac{3y_0^2}{3\kappa+1}+\frac{11 d_1' y_0}{3(3\kappa+1)}+\frac{77 d_1'\kappa y_0}{3(3\kappa+1)}-\frac{452\kappa y_0}{3(3\kappa+1)}-\frac{12y_0}{3\kappa+1}+\Bigg(\frac{20\kappa y_0^3}{3\kappa+1}+\frac{4y_0^3}{3(3\kappa+1)}-$$

$$\frac{90\kappa y_0^2}{3\kappa+1}-\frac{6y_0^2}{3\kappa+1}+\frac{180\kappa y_0}{3\kappa+1}+\frac{12y_0}{3\kappa+1}\Bigg)H(0;y_0)+\Bigg(\frac{2d_1' y_0^3}{3(3\kappa+1)}+\frac{14 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{3d_1' y_0^2}{3\kappa+1}-\frac{21 d_1'\kappa y_0^2}{3\kappa+1}-\frac{24\kappa y_0^2}{3\kappa+1}+$$

$$\frac{6d_1' y_0}{3\kappa+1}+\frac{42 d_1'\kappa y_0}{3\kappa+1}+\frac{48\kappa y_0}{3\kappa+1}-\frac{11 d_1'}{3(3\kappa+1)}-\frac{77 d_1'\kappa}{3(3\kappa+1)}-\frac{88\kappa}{3(3\kappa+1)}\Bigg)H(1;y_0)+\Bigg(-\frac{60\kappa}{(\kappa+1)^2}-\frac{4}{(\kappa+1)^2}\Bigg)H(0,0;y_0)+\Bigg(-$$

$$\frac{14\kappa d_1'}{(\kappa+1)^2}-\frac{2d_1'}{(\kappa+1)^2}-\frac{16\kappa}{(\kappa+1)^2}\Bigg)H(0,1;y_0)+\frac{2\kappa\pi^2}{3(3\kappa+1)}\Bigg)H(1,0;Y)+\Bigg(\frac{2\kappa y_0^3 d_1'^3}{9(3\kappa+1)}+\frac{2y_0^3 d_1'^3}{9(3\kappa+1)}-\frac{7\kappa y_0^2 d_1'^3}{6(3\kappa+1)}-\frac{7y_0^2 d_1'^3}{6(3\kappa+1)}+$$

$$\frac{11\kappa y_0 d_1'^3}{3(3\kappa+1)}+\frac{11 y_0 d_1'^3}{3(3\kappa+1)}-\frac{49\kappa d_1'^3}{18(3\kappa+1)}-\frac{49 d_1'^3}{18(3\kappa+1)}-\frac{4y_0^3 d_1'^2}{9(3\kappa+1)}+\frac{2\kappa y_0^2 d_1'^2}{3\kappa+1}+\frac{3y_0^2 d_1'^2}{3\kappa+1}-\frac{14\kappa y_0 d_1'^2}{3\kappa+1}-\frac{12 y_0 d_1'^2}{3\kappa+1}+\frac{12\kappa d_1'^2}{3\kappa+1}+$$

$$\frac{85 d_1'^2}{9(3\kappa+1)}-\frac{20\kappa y_0^3 d_1'}{9(3\kappa+1)}+\frac{17\kappa y_0^2 d_1'}{3\kappa+1}-\frac{74\kappa y_0 d_1'}{3\kappa+1}+\frac{533\kappa d_1'}{9(3\kappa+1)}-\frac{4\kappa y_0^3}{3(3\kappa+1)}+\frac{29\kappa y_0^2}{3(3\kappa+1)}-\frac{122\kappa y_0}{3(3\kappa+1)}+\frac{97\kappa}{3(3\kappa+1)}\Bigg)H(1,1;y_0)-$$

$$\frac{1}{6}\pi^2 H(1,1;Y)+\Bigg(\frac{80\kappa y_0^3}{3\kappa+1}+\frac{16y_0^3}{3(3\kappa+1)}-\frac{360\kappa y_0^2}{3\kappa+1}-\frac{24y_0^2}{3\kappa+1}+\frac{720\kappa y_0}{3\kappa+1}+\frac{48y_0}{3\kappa+1}\Bigg)H(0,0,0;y_0)+\Bigg(\frac{10\kappa y_0^3}{3\kappa+1}+$$

$$\frac{2y_0^3}{3(3\kappa+1)}-\frac{45\kappa y_0^2}{3\kappa+1}-\frac{3y_0^2}{3\kappa+1}+\frac{90\kappa y_0}{3\kappa+1}+\frac{6y_0}{3\kappa+1}+\Bigg(-\frac{30\kappa}{(\kappa+1)^2}-\frac{2}{(\kappa+1)^2}\Bigg)H(0;y_0)\Bigg)H(0,0,0;Y)+\Bigg(\frac{8d_1' y_0^3}{3(3\kappa+1)}+$$

$$\frac{56 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{64\kappa y_0^3}{3(3\kappa+1)}-\frac{12 d_1' y_0^2}{3\kappa+1}-\frac{84 d_1'\kappa y_0^2}{3\kappa+1}-\frac{96\kappa y_0^2}{3\kappa+1}+\frac{24 d_1' y_0}{3\kappa+1}+\frac{168 d_1'\kappa y_0}{3\kappa+1}+\frac{192\kappa y_0}{3\kappa+1}\Bigg)H(0,0,1;y_0)+\Bigg(\frac{8d_1' y_0^3}{3(3\kappa+1)}+$$

$$\frac{56 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{64\kappa y_0^3}{3(3\kappa+1)}-\frac{12 d_1' y_0^2}{3\kappa+1}-\frac{84 d_1'\kappa y_0^2}{3\kappa+1}-\frac{96\kappa y_0^2}{3\kappa+1}+\frac{24 d_1' y_0}{3\kappa+1}+\frac{168 d_1'\kappa y_0}{3\kappa+1}+\frac{192\kappa y_0}{3\kappa+1}\Bigg)H(0,1,0;y_0)+\Bigg(\frac{10\kappa y_0^3}{3\kappa+1}+$$

$$\frac{2y_0^3}{3(3\kappa+1)}-\frac{45\kappa y_0^2}{3\kappa+1}-\frac{3y_0^2}{3\kappa+1}+\frac{90\kappa y_0}{3\kappa+1}+\frac{6y_0}{3\kappa+1}+\Bigg(-\frac{30\kappa}{(\kappa+1)^2}-\frac{2}{(\kappa+1)^2}\Bigg)H(0;y_0)\Bigg)H(0,1,0;Y)+\Bigg(\frac{4d_1'^2 y_0^3}{3(3\kappa+1)}+$$

$$\frac{4d_1'^2\kappa y_0^3}{3\kappa+1}+\frac{32 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{6d_1'^2 y_0^2}{3\kappa+1}-\frac{18 d_1'^2\kappa y_0^2}{3\kappa+1}-\frac{48 d_1'\kappa y_0^2}{3\kappa+1}-\frac{24\kappa y_0^2}{3\kappa+1}+\frac{12 d_1'^2 y_0}{3\kappa+1}+\frac{36 d_1'^2\kappa y_0}{3\kappa+1}+\frac{96 d_1'\kappa y_0}{3\kappa+1}+$$

$$\frac{48\kappa y_0}{3\kappa+1}\Bigg)H(0,1,1;y_0)+\Bigg(\frac{8d_1' y_0^3}{3(3\kappa+1)}+\frac{56 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{64\kappa y_0^3}{3(3\kappa+1)}-\frac{12 d_1' y_0^2}{3\kappa+1}-\frac{84 d_1'\kappa y_0^2}{3\kappa+1}-\frac{96\kappa y_0^2}{3\kappa+1}+\frac{24 d_1' y_0}{3\kappa+1}+\frac{168 d_1'\kappa y_0}{3\kappa+1}+$$

$$\frac{192\kappa y_0}{3\kappa+1}-\frac{44 d_1'}{3(3\kappa+1)}-\frac{308 d_1'\kappa}{3(3\kappa+1)}-\frac{352\kappa}{3(3\kappa+1)}\Bigg)H(1,0,0;y_0)+\Bigg(\frac{14\kappa y_0^3}{3(3\kappa+1)}+\frac{2y_0^3}{3(3\kappa+1)}-\frac{21\kappa y_0^2}{3\kappa+1}-\frac{3y_0^2}{3\kappa+1}+\frac{42\kappa y_0}{3\kappa+1}+$$

$$\frac{6y_0}{3\kappa+1}+\Bigg(-\frac{14\kappa}{(\kappa+1)^2}-\frac{2}{(\kappa+1)^2}\Bigg)H(0;y_0)\Bigg)H(1,0,0;Y)+\Bigg(\frac{4d_1'^2 y_0^3}{3(3\kappa+1)}+\frac{4d_1'^2\kappa y_0^3}{3\kappa+1}+\frac{32 d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-$$

$$\frac{6d_1'^2y_0^2}{3\kappa+1}-\frac{18d_1'^2\kappa y_0^2}{3\kappa+1}-\frac{48d_1'\kappa y_0^2}{3\kappa+1}-\frac{24\kappa y_0^2}{3\kappa+1}+\frac{12d_1'^2y_0}{3\kappa+1}+\frac{36d_1'^2\kappa y_0}{3\kappa+1}+\frac{96d_1'\kappa y_0}{3\kappa+1}+\frac{48\kappa y_0}{3\kappa+1}-\frac{22d_1'^2}{3(3\kappa+1)}-\frac{22d_1'^2\kappa}{3\kappa+1}-\frac{176d_1'\kappa}{3(3\kappa+1)}-$$

$$\frac{88\kappa}{3(3\kappa+1)}\bigg)H(1,0,1;y_0)+\bigg(\frac{4d_1'^2y_0^3}{3(3\kappa+1)}+\frac{4d_1'^2\kappa y_0^3}{3\kappa+1}+\frac{32d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{16\kappa y_0^3}{3(3\kappa+1)}-\frac{6d_1'^2y_0^2}{3\kappa+1}-\frac{18d_1'^2\kappa y_0^2}{3\kappa+1}-\frac{48d_1'\kappa y_0^2}{3\kappa+1}-\frac{24\kappa y_0^2}{3\kappa+1}+$$

$$\frac{12d_1'^2y_0}{3\kappa+1}+\frac{36d_1'^2\kappa y_0}{3\kappa+1}+\frac{96d_1'\kappa y_0}{3\kappa+1}+\frac{48\kappa y_0}{3\kappa+1}-\frac{22d_1'^2}{3(3\kappa+1)}-\frac{22d_1'^2\kappa}{3\kappa+1}-\frac{176d_1'\kappa}{3(3\kappa+1)}-\frac{88\kappa}{3(3\kappa+1)}\bigg)H(1,1,0;y_0)+\bigg(\frac{14\kappa y_0^3}{3(3\kappa+1)}+$$

$$\frac{2y_0^3}{3(3\kappa+1)}-\frac{21\kappa y_0^2}{3\kappa+1}-\frac{3y_0^2}{3\kappa+1}+\frac{42\kappa y_0}{3\kappa+1}+\frac{6y_0}{3\kappa+1}+\bigg(-\frac{14\kappa}{(\kappa+1)^2}-\frac{2}{(\kappa+1)^2}\bigg)H(0;y_0)\bigg)H(1,1,0;Y)+\bigg(\frac{2\kappa y_0^3d_1'^3}{3(3\kappa+1)}+$$

$$\frac{2y_0^3d_1'^3}{3(3\kappa+1)}-\frac{3\kappa y_0^2d_1'^3}{3\kappa+1}-\frac{3y_0^2d_1'^3}{3\kappa+1}+\frac{6\kappa y_0d_1'^3}{3\kappa+1}+\frac{6y_0d_1'^3}{3\kappa+1}-\frac{11\kappa d_1'^3}{3(3\kappa+1)}-\frac{11d_1'^3}{3(3\kappa+1)}+\frac{4\kappa y_0^3d_1'^2}{3\kappa+1}-\frac{18\kappa y_0^2d_1'^2}{3\kappa+1}+\frac{36\kappa y_0d_1'^2}{3\kappa+1}-$$

$$\frac{22\kappa d_1'^2}{3\kappa+1}+\frac{4\kappa y_0^3d_1'}{3\kappa+1}-\frac{18\kappa y_0^2d_1'}{3\kappa+1}+\frac{36\kappa y_0d_1'}{3\kappa+1}-\frac{22\kappa d_1'}{3\kappa+1}+\frac{4\kappa y_0^3}{3(3\kappa+1)}-\frac{6\kappa y_0^2}{3\kappa+1}+\frac{12\kappa y_0}{3\kappa+1}-\frac{22\kappa}{3(3\kappa+1)}\bigg)H(1,1,1;y_0)+$$

$$\bigg(-\frac{240\kappa}{(\kappa+1)^2}-\frac{16}{(\kappa+1)^2}\bigg)H(0,0,0,0;y_0)+\bigg(-\frac{15\kappa}{(\kappa+1)^2}-\frac{1}{(\kappa+1)^2}\bigg)H(0,0,0,0;Y)+\bigg(-\frac{56\kappa d_1'}{(\kappa+1)^2}-$$

$$\frac{8d_1'}{(\kappa+1)^2}-\frac{64\kappa}{(\kappa+1)^2}\bigg)H(0,0,0,1;y_0)+\bigg(-\frac{56\kappa d_1'}{(\kappa+1)^2}-\frac{8d_1'}{(\kappa+1)^2}-\frac{64\kappa}{(\kappa+1)^2}\bigg)H(0,0,1,0;y_0)+\bigg(-\frac{15\kappa}{(\kappa+1)^2}-$$

$$\frac{1}{(\kappa+1)^2}\bigg)H(0,0,1,0;Y)+\bigg(-\frac{12\kappa d_1'^2}{(\kappa+1)^2}-\frac{4d_1'^2}{(\kappa+1)^2}-\frac{32\kappa d_1'}{(\kappa+1)^2}-\frac{16\kappa}{(\kappa+1)^2}\bigg)H(0,0,1,1;y_0)+\bigg(-\frac{56\kappa d_1'}{(\kappa+1)^2}-$$

$$\frac{8d_1'}{(\kappa+1)^2}-\frac{64\kappa}{(\kappa+1)^2}\bigg)H(0,1,0,0;y_0)+\bigg(-\frac{7\kappa}{(\kappa+1)^2}-\frac{1}{(\kappa+1)^2}\bigg)H(0,1,0,0;Y)+\bigg(-\frac{12\kappa d_1'^2}{(\kappa+1)^2}-\frac{4d_1'^2}{(\kappa+1)^2}-$$

$$\frac{32\kappa d_1'}{(\kappa+1)^2}-\frac{16\kappa}{(\kappa+1)^2}\bigg)H(0,1,0,1;y_0)+\bigg(-\frac{12\kappa d_1'^2}{(\kappa+1)^2}-\frac{4d_1'^2}{(\kappa+1)^2}-\frac{32\kappa d_1'}{(\kappa+1)^2}-\frac{16\kappa}{(\kappa+1)^2}\bigg)H(0,1,1,0;y_0)+\bigg(-$$

$$\frac{7\kappa}{(\kappa+1)^2}-\frac{1}{(\kappa+1)^2}\bigg)H(0,1,1,0;Y)+\bigg(-\frac{2\kappa d_1'^3}{(\kappa+1)^2}-\frac{2d_1'^3}{(\kappa+1)^2}-\frac{12\kappa d_1'^2}{(\kappa+1)^2}-\frac{12\kappa d_1'}{(\kappa+1)^2}-\frac{4\kappa}{(\kappa+1)^2}\bigg)H(0,1,1,1;y_0)+$$

$$\bigg(-\frac{11\kappa}{(\kappa+1)^2}-\frac{1}{(\kappa+1)^2}\bigg)H(1,0,0,0;Y)+\bigg(-\frac{11\kappa}{(\kappa+1)^2}-\frac{1}{(\kappa+1)^2}\bigg)H(1,0,1,0;Y)-H(1,1,0,0;Y)-$$

$$H(1,1,1,0;Y)+H(0;y_0)\bigg(\frac{4d_1'^2y_0^3}{27(3\kappa+1)}-\frac{16d_1'y_0^3}{27(3\kappa+1)}+\frac{4d_1'^2\kappa y_0^3}{9(3\kappa+1)}-\frac{80d_1'\kappa y_0^3}{27(3\kappa+1)}+\frac{128\kappa y_0^3}{27(3\kappa+1)}+\frac{16y_0^3}{27(3\kappa+1)}-\frac{17d_1'^2y_0^2}{18(3\kappa+1)}+$$

$$\frac{44d_1'y_0^2}{9(3\kappa+1)}-\frac{17d_1'^2\kappa y_0^2}{6(3\kappa+1)}+\frac{80d_1'\kappa y_0^2}{3(3\kappa+1)}-\frac{164\kappa y_0^2}{3(3\kappa+1)}-\frac{6y_0^2}{3\kappa+1}+\frac{49d_1'^2y_0}{9(3\kappa+1)}-\frac{302d_1'y_0}{9(3\kappa+1)}+\frac{49d_1'^2\kappa y_0}{3(3\kappa+1)}-\frac{574d_1'\kappa y_0}{3(3\kappa+1)}+\frac{1420\kappa y_0}{3(3\kappa+1)}+$$

$$\frac{48y_0}{3\kappa+1}-\frac{92\kappa\zeta_3}{3\kappa+1}-\frac{4\zeta_3}{3\kappa+1}\bigg)+H(0;Y)\bigg(\frac{2d_1'^2y_0^3}{27(3\kappa+1)}-\frac{8d_1'y_0^3}{27(3\kappa+1)}+\frac{2d_1'^2\kappa y_0^3}{9(3\kappa+1)}-\frac{40d_1'\kappa y_0^3}{27(3\kappa+1)}+\frac{64\kappa y_0^3}{27(3\kappa+1)}+\frac{8y_0^3}{27(3\kappa+1)}-$$

$$\frac{17d_1'^2y_0^2}{36(3\kappa+1)}+\frac{22d_1'y_0^2}{9(3\kappa+1)}-\frac{17d_1'^2\kappa y_0^2}{12(3\kappa+1)}+\frac{40d_1'\kappa y_0^2}{3(3\kappa+1)}-\frac{82\kappa y_0^2}{3(3\kappa+1)}-\frac{3y_0^2}{3\kappa+1}+\frac{49d_1'^2y_0}{18(3\kappa+1)}-\frac{151d_1'y_0}{9(3\kappa+1)}+\frac{49d_1'^2\kappa y_0}{6(3\kappa+1)}-\frac{287d_1'\kappa y_0}{3(3\kappa+1)}+$$

$$\frac{710\kappa y_0}{3(3\kappa+1)}+\frac{24y_0}{3\kappa+1}+\bigg(\frac{4d_1'y_0^3}{9(3\kappa+1)}+\frac{28d_1'\kappa y_0^3}{9(3\kappa+1)}-\frac{88\kappa y_0^3}{9(3\kappa+1)}-\frac{8y_0^3}{9(3\kappa+1)}-\frac{7d_1'y_0^2}{3(3\kappa+1)}-\frac{49d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{214\kappa y_0^2}{3(3\kappa+1)}+\frac{6y_0^2}{3\kappa+1}+$$

$$\frac{22d_1'y_0}{3(3\kappa+1)}+\frac{154d_1'\kappa y_0}{3(3\kappa+1)}-\frac{904\kappa y_0}{3(3\kappa+1)}-\frac{24y_0}{3\kappa+1}\bigg)H(0;y_0)+\bigg(\frac{2d_1'^2y_0^3}{9(3\kappa+1)}-\frac{4d_1'y_0^3}{9(3\kappa+1)}+\frac{2d_1'^2\kappa y_0^3}{3(3\kappa+1)}-\frac{4d_1'\kappa y_0^3}{3(3\kappa+1)}-\frac{8\kappa y_0^3}{3(3\kappa+1)}-$$

$$\frac{7d_1'^2y_0^2}{6(3\kappa+1)}+\frac{3d_1'y_0^2}{3\kappa+1}-\frac{7d_1'^2\kappa y_0^2}{2(3\kappa+1)}+\frac{35d_1'\kappa y_0^2}{3(3\kappa+1)}+\frac{58\kappa y_0^2}{3(3\kappa+1)}+\frac{11d_1'^2y_0}{3(3\kappa+1)}-\frac{12d_1'y_0}{3\kappa+1}+\frac{11d_1'^2\kappa y_0}{3\kappa+1}-\frac{164d_1'\kappa y_0}{3(3\kappa+1)}-\frac{244\kappa y_0}{3(3\kappa+1)}-$$

$$\frac{49d_1'^2}{18(3\kappa+1)}+\frac{85d_1'}{9(3\kappa+1)}-\frac{49d_1'^2\kappa}{6(3\kappa+1)}+\frac{133d_1'\kappa}{3(3\kappa+1)}+\frac{194\kappa}{3(3\kappa+1)}\bigg)H(1;y_0)+\bigg(\frac{40\kappa y_0^3}{3\kappa+1}+\frac{8y_0^3}{3(3\kappa+1)}-\frac{180\kappa y_0^2}{3\kappa+1}-\frac{12y_0^2}{3\kappa+1}+$$

$$\frac{360\kappa y_0}{3\kappa+1}+\frac{24y_0}{3\kappa+1}\bigg)H(0,0;y_0)+\bigg(\frac{4d_1'y_0^3}{3(3\kappa+1)}+\frac{28d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{32\kappa y_0^3}{3(3\kappa+1)}-\frac{6d_1'y_0^2}{3\kappa+1}-\frac{42d_1'\kappa y_0^2}{3\kappa+1}-\frac{48\kappa y_0^2}{3\kappa+1}+\frac{12d_1'y_0}{3\kappa+1}+\frac{84d_1'\kappa y_0}{3\kappa+1}+$$

$$\frac{96\kappa y_0}{3\kappa+1}\bigg)H(0,1;y_0)+\bigg(\frac{4d_1'y_0^3}{3(3\kappa+1)}+\frac{28d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{32\kappa y_0^3}{3(3\kappa+1)}-\frac{6d_1'y_0^2}{3\kappa+1}-\frac{42d_1'\kappa y_0^2}{3\kappa+1}-\frac{48\kappa y_0^2}{3\kappa+1}+\frac{12d_1'y_0}{3\kappa+1}+\frac{84d_1'\kappa y_0}{3\kappa+1}+\frac{96\kappa y_0}{3\kappa+1}-$$

$$\frac{22d_1'}{3(3\kappa+1)}-\frac{154d_1'\kappa}{3(3\kappa+1)}-\frac{176\kappa}{3(3\kappa+1)}\bigg)H(1,0;y_0)+\bigg(\frac{2d_1'^2y_0^3}{3(3\kappa+1)}+\frac{2d_1'^2\kappa y_0^3}{3\kappa+1}+\frac{16d_1'\kappa y_0^3}{3(3\kappa+1)}+\frac{8\kappa y_0^3}{3(3\kappa+1)}-\frac{3d_1'^2y_0^2}{3\kappa+1}-\frac{9d_1'^2\kappa y_0^2}{3\kappa+1}-$$

$$\frac{24d_1'\kappa y_0^2}{3\kappa+1}-\frac{12\kappa y_0^2}{3\kappa+1}+\frac{6d_1'^2y_0}{3\kappa+1}+\frac{18d_1'^2\kappa y_0}{3\kappa+1}+\frac{48d_1'\kappa y_0}{3\kappa+1}+\frac{24\kappa y_0}{3\kappa+1}-\frac{11d_1'^2}{3(3\kappa+1)}-\frac{11d_1'^2\kappa}{3\kappa+1}-\frac{88d_1'\kappa}{3(3\kappa+1)}-\frac{44\kappa}{3(3\kappa+1)}\bigg)H(1,1;y_0)+$$

$$\bigg(-\frac{120\kappa}{(\kappa+1)^2}-\frac{8}{(\kappa+1)^2}\bigg)H(0,0,0;y_0)+\bigg(-\frac{28\kappa d_1'}{(\kappa+1)^2}-\frac{4d_1'}{(\kappa+1)^2}-\frac{32\kappa}{(\kappa+1)^2}\bigg)H(0,0,1;y_0)+\bigg(-\frac{28\kappa d_1'}{(\kappa+1)^2}-$$

$$\frac{4d_1'}{(\kappa+1)^2}-\frac{32\kappa}{(\kappa+1)^2}\bigg)H(0,1,0;y_0)+\bigg(-\frac{6\kappa d_1'^2}{(\kappa+1)^2}-\frac{2d_1'^2}{(\kappa+1)^2}-\frac{16\kappa d_1'}{(\kappa+1)^2}-\frac{8\kappa}{(\kappa+1)^2}\bigg)H(0,1,1;y_0)-\frac{46\kappa\zeta_3}{3\kappa+1}-\frac{2\zeta_3}{3\kappa+1}\bigg)+$$

$$H(1;Y)\bigg(\frac{7\kappa\pi^2y_0^3}{9(3\kappa+1)}+\frac{\pi^2y_0^3}{9(3\kappa+1)}-\frac{7\kappa\pi^2y_0^2}{2(3\kappa+1)}-\frac{\pi^2y_0^2}{2(3\kappa+1)}+\frac{7\kappa\pi^2y_0}{3\kappa+1}+\frac{\pi^2y_0}{3\kappa+1}+\bigg(-\frac{7\pi^2\kappa}{3(3\kappa+1)}-\frac{\pi^2}{3(3\kappa+1)}\bigg)H(0;y_0)-$$

$$\frac{16\kappa\zeta_3}{3\kappa+1}\bigg)+\frac{92\kappa y_0^3\zeta_3}{3(3\kappa+1)}+\frac{4y_0^3\zeta_3}{3(3\kappa+1)}-\frac{138\kappa y_0^2\zeta_3}{3\kappa+1}-\frac{6y_0^2\zeta_3}{3\kappa+1}+\frac{276\kappa y_0\zeta_3}{3\kappa+1}+\frac{12y_0\zeta_3}{3\kappa+1}+\frac{11\kappa\pi^4}{30(3\kappa+1)}+\frac{\pi^4}{30(3\kappa+1)}.$$

C. The $\mathcal{K}$ integrals

C.1 The $\mathcal{K}$ integral for $\kappa = 0$

The ε expansion for this integral reads

$$\mathcal{K}(\varepsilon; y_0, 3 + d_1'\varepsilon; 0) = \frac{1}{\varepsilon^2} k_{-2}^{(0)} + \frac{1}{\varepsilon} k_{-1}^{(0)} + k_0^{(0)} + \varepsilon k_1^{(0)} + \varepsilon^2 k_2^{(0)} + \mathcal{O}\left(\varepsilon^3\right), \tag{C.1}$$

where

$$k_{-2}^{(0)} = 1,$$

$$k_{-1}^{(0)} = \tfrac{2y_0^3}{3} - 3y_0^2 + 6y_0 - 2H(0; y_0),$$

$$k_0^{(0)} = -\tfrac{2d_1' x^3}{9} + \tfrac{10x^3}{9} + \tfrac{7d_1' x^2}{6} - 5\ x^2 - \tfrac{11 d_1' x}{3} + 14x + \Big(- \tfrac{4x^3}{3} + 6x^2 - 12x \Big)\ H(0; x) + \Big(- \tfrac{2d_1' x^3}{3} + 3d_1' x^2 - 6d_1' x + \tfrac{11\ d_1'}{3} \Big) H(1; x) + 4H(0, 0; x) + 2d_1' H(0, 1; x) - \tfrac{\pi^2}{6},$$

$$k_1^{(0)} = \tfrac{2d_1'^2 x^3}{27} - \tfrac{14d_1' x^3}{27} - \tfrac{\pi^2\ x^3}{9} + \tfrac{56x^3}{27} - \tfrac{17d_1'^2 x^2}{36} + \tfrac{28d_1'\ x^2}{9} + \tfrac{\pi^2 x^2}{2} - 9x^2 + \tfrac{49d_1'^2 x}{18} - \tfrac{157\ d_1' x}{9} - \pi^2 x + 32x + \Big(\tfrac{4d_1' x^3}{9} - \tfrac{20\ x^3}{9} - \tfrac{7d_1' x^2}{3} + 10x^2 + \tfrac{22d_1' x}{3} - 28\ x + \tfrac{\pi^2}{3} \Big) H(0; x) + \Big(\tfrac{2d_1'^2 x^3}{9} - \tfrac{10\ d_1' x^3}{9} - \tfrac{7d_1'^2 x^2}{6} + 5d_1' x^2 + \tfrac{11d_1'^2\ x}{3} - 14d_1' x - \tfrac{49d_1'^2}{18} + \tfrac{91d_1'}{9} \Big)\ H(1; x) + \Big(\tfrac{8x^3}{3} - 12x^2 + 24x \Big) H(0, 0; x) + \Big(\tfrac{4\ d_1' x^3}{3} - 6d_1' x^2 + 12d_1' x \Big) H(0, 1; x) + \Big(\tfrac{4d_1'\ x^3}{3} - 6d_1' x^2 + 12d_1' x - \tfrac{22d_1'}{3} \Big)\ H(1, 0; x) + \Big(\tfrac{2d_1'^2 x^3}{3} - 3d_1'^2 x^2 + 6d_1'^2 x - \tfrac{11\ d_1'^2}{3} \Big) H(1, 1; x) - 8H(0, 0, 0; x) - 4d_1' H(0, 0, 1; x) - 4d_1'\ H(0, 1, 0; x) - 2d_1'^2 H(0, 1, 1; x) - 2\zeta_3,$$

$$k_2^{(0)} = -\tfrac{2}{81} x^3 d_1'^3 + \tfrac{43x^2 d_1'^3}{216} - \tfrac{251x\ d_1'^3}{108} + 2H(0, 1, 1, 1; x) d_1'^3 + \tfrac{2x^3 d_1'^2}{9} - \tfrac{191\ x^2 d_1'^2}{108} + \tfrac{548x d_1'^2}{27} + 4H(0, 0, 1, 1; x) d_1'^2 + 4\ H(0, 1, 0, 1; x) d_1'^2 + 4H(0, 1, 1, 0; x) d_1'^2 + \tfrac{1}{27}\pi^2 x^3\ d_1' - \tfrac{28x^3 d_1'}{27} - \tfrac{7}{36}\pi^2 x^2 d_1' + \tfrac{355\ x^2 d_1'}{54} + \tfrac{11}{18}\pi^2 x d_1' - \tfrac{1619x d_1'}{27} + 8\ H(0, 0, 0, 1; x) d_1' + 8H(0, 0, 1, 0; x) d_1' + 8H(0, 1, 0, 0; x) d_1' - \tfrac{5\pi\ ^2 x^3}{27} + \tfrac{328x^3}{81} + \tfrac{5\pi^2 x^2}{6} - 17x^2 - \tfrac{7\ \pi^2 x}{3} + 72x + \Big(- \tfrac{2}{27} x^3 d_1'^3 + \tfrac{17x^2\ d_1'^3}{36} - \tfrac{49x d_1'^3}{18} + \tfrac{251d_1'^3}{108} + \tfrac{14\ x^3 d_1'^2}{27} - \tfrac{28x^2 d_1'^2}{9} + \tfrac{157x\ d_1'^2}{9} - \tfrac{401d_1'^2}{27} + \tfrac{1}{9}\pi^2 x^3 d_1' - \tfrac{56\ x^3 d_1'}{27} - \tfrac{1}{2}\pi^2 x^2 d_1' + 9x^2 d_1' + \pi^2 x d_1' - 32\ x d_1' - \tfrac{11\pi^2 d_1'}{18} + \tfrac{677d_1'}{27} \Big)\ H(1; x) + \Big(- \tfrac{8d_1' x^3}{9} + \tfrac{40x^3}{9} + \tfrac{14d_1'\ x^2}{3} - 20x^2 - \tfrac{44d_1' x}{3} + 56x - \tfrac{2\pi^2}{3} \Big)\ H(0, 0; x) + \Big(- \tfrac{4}{9} d_1'^2 x^3 + \tfrac{20d_1' x^3}{9} + \tfrac{7\ d_1'^2 x^2}{3} - 10d_1' x^2 - \tfrac{22d_1'^2 x}{3} + 28d_1' x - \tfrac{d_1'\ \pi^2}{3} \Big) H(0, 1; x) + \Big(- \tfrac{4}{9} d_1'^2 x^3 + \tfrac{20d_1'\ x^3}{9} + \tfrac{7d_1'^2 x^2}{3} - 10d_1' x^2 - \tfrac{22d_1'^2 x}{3} + 28\ d_1' x + \tfrac{49d_1'^2}{9} - \tfrac{182d_1'}{9} \Big)\ H(1, 0; x) + \Big(- \tfrac{2}{9} x^3 d_1'^3 + \tfrac{7x^2 d_1'^3}{6} - \tfrac{11\ x d_1'^3}{3} + \tfrac{49d_1'^3}{18} + \tfrac{10x^3 d_1'^2}{9} - 5x^2\ d_1'^2 + 14x d_1'^2 - \tfrac{91d_1'^2}{9} \Big) H(1, 1; x) + \Big(- \tfrac{16\ x^3}{3} + 24x^2 - 48x \Big) H(0, 0, 0; x) + \Big(- \tfrac{8d_1' x^3}{3} + 12\ d_1' x^2 - 24d_1' x \Big) H(0, 0, 1; x) + \Big(- \tfrac{8d_1' x^3}{3} + 12d_1'\ x^2 - 24d_1' x \Big) H(0, 1, 0; x) + \Big(- \tfrac{4}{3} d_1'^2 x^3 + 6d_1'^2\ x^2 - 12d_1'^2 x \Big) H(0, 1, 1; x) + \Big(- \tfrac{8d_1' x^3}{3} + 12d_1'\ x^2 - 24d_1' x + \tfrac{44d_1'}{3} \Big) H(1, 0, 0; x) + \Big(- \tfrac{4}{3}\ d_1'^2 x^3 + 6d_1'^2 x^2 - 12d_1'^2 x + \tfrac{22d_1'^2}{3} \Big)\ H(1, 0, 1; x) + \Big(- \tfrac{4}{3} d_1'^2 x^3 + 6d_1'^2 x^2 - 12d_1'^2\ x + \tfrac{22d_1'^2}{3} \Big) H(1, 1, 0; x) + \Big(- \tfrac{2}{3} x^3 d_1'^3 + 3\ x^2 d_1'^3 - 6x d_1'^3 + \tfrac{11d_1'^3}{3} \Big) H(1, 1, 1; x) + 16\ H(0, 0, 0, 0; x) + H(0; x) \Big(- \tfrac{4}{27} d_1'^2 x^3 + \tfrac{28d_1'\ x^3}{27} + \tfrac{2\pi^2 x^3}{9} - \tfrac{112x^3}{27} + \tfrac{17d_1'^2\ x^2}{18} - \tfrac{56d_1' x^2}{9} - \pi^2 x^2 + 18x^2 - \tfrac{49d_1'^2\ x}{9} + \tfrac{314d_1' x}{9} + 2\pi^2 x - 64x + 4\zeta_3 \Big) - \tfrac{4}{3}\ x^3\zeta_3 + 6x^2\zeta_3 - 12x\zeta_3 - \tfrac{\pi^4}{40}.$$

C.2 The $\mathcal{K}$ integral for $\kappa = 1$

The ε expansion for this integral reads

$$\mathcal{K}(\varepsilon; y_0, 3 + d_1'\varepsilon;) = \frac{1}{\varepsilon^2} k_{-2}^{(1)} + \frac{1}{\varepsilon} k_{-1}^{(1)} + k_0^{(1)} + \varepsilon k_1^{(1)} + \varepsilon^2 k_2^{(1)} + \mathcal{O}\left(\varepsilon^3\right), \tag{C.2}$$

where

$$k_{-2}^{(1)} = \tfrac{1}{4},$$

$$k_{-1}^{(1)} = \tfrac{y_0^3}{3} - \tfrac{3y_0^2}{2} + 3y_0 - H(0; y_0),$$

$$k_0^{(1)} = -\tfrac{d_1' x^3}{9} + x^3 + \tfrac{7d_1' x^2}{12} - \tfrac{53\ x^2}{12} - \tfrac{11 d_1' x}{6} + \tfrac{73x}{6} + \Big(-\tfrac{4x^3}{3} + 6\ x^2 - 12x\Big)H(0;x) + \Big(-\tfrac{d_1' x^3}{3} - \tfrac{x^3}{3} + \tfrac{3\ d_1' x^2}{2} + \tfrac{3x^2}{2} - 3d_1' x - 3x + \tfrac{11\ d_1'}{6} + \tfrac{11}{6}\Big)H(1;x) + 4H(0,0;x) + (d_1' + 1)H(0,1;x) - \tfrac{\pi^2}{12},$$

$$k_1^{(1)} = \tfrac{d_1'^2 x^3}{27} - \tfrac{4d_1' x^3}{9} - \tfrac{\pi^2\ x^3}{9} + \tfrac{7x^3}{3} - \tfrac{17 d_1'^2 x^2}{72} + \tfrac{95 d_1'\ x^2}{36} + \tfrac{\pi^2 x^2}{2} - \tfrac{259x^2}{24} + \tfrac{49 d_1'^2\ x}{36} - \tfrac{265 d_1' x}{18} - \pi^2 x + \tfrac{515x}{12} + \Big(\tfrac{4\ d_1' x^3}{9} - 4x^3 - \tfrac{7d_1' x^2}{3} + \tfrac{53x^2}{3} + \tfrac{22\ d_1' x}{3} - \tfrac{146x}{3} + \tfrac{\pi^2}{3}\Big)\ H(0;x) + \Big(\tfrac{d_1'^2 x^3}{9} - \tfrac{8d_1' x^3}{9} - x^3 - \tfrac{7\ d_1'^2 x^2}{12} + \tfrac{23 d_1' x^2}{6} + \tfrac{61x^2}{12} + \tfrac{11\ d_1'^2 x}{6} - \tfrac{31 d_1' x}{3} - \tfrac{83x}{6} - \tfrac{49 d_1'^2}{36} + \tfrac{133 d_1'}{18} + \tfrac{39}{4}\Big)H(1;x) + \Big(\tfrac{16x^3}{3} - 24\ x^2 + 48x\Big)H(0,0;x) + \Big(\tfrac{4d_1' x^3}{3} + \tfrac{2x^3}{3} - 6\ d_1' x^2 - 3x^2 + 12 d_1' x + 6x + 2\Big)H(0,1;x) + \Big(\tfrac{4d_1'\ x^3}{3} + \tfrac{4x^3}{3} - 6d_1' x^2 - 6x^2 + 12 d_1' x + 12x - \tfrac{22\ d_1'}{3} - \tfrac{22}{3}\Big)H(1,0;x) + \Big(\tfrac{d_1'^2 x^3}{3} + \tfrac{2\ d_1' x^3}{3} - \tfrac{x^3}{3} - \tfrac{3d_1'^2 x^2}{2} - 3d_1' x^2 + \tfrac{3\ x^2}{2} + 3d_1'^2 x + 6d_1' x - 3x - \tfrac{11 d_1'^2}{6} - \tfrac{11\ d_1'}{3} + \tfrac{11}{6}\Big)H(1,1;x) - 16H(0,0,0;x) + (-4d_1' - 2)\ H(0,0,1;x) + (-4d_1' - 4)H(0,1,0;x) + \Big(-d_1'^2 - 2d_1' + 1\Big)\ H(0,1,1;x) - \tfrac{3\zeta_3}{2},$$

$$k_2^{(1)} = -\tfrac{1}{81} x^3 d_1'^3 + \tfrac{43x^2 d_1'^3}{432} - \tfrac{251x\ d_1'^3}{216} + \tfrac{5x^3 d_1'^2}{27} - \tfrac{635x^2\ d_1'^2}{432} + \tfrac{3631 x d_1'^2}{216} + \tfrac{1}{27}\pi^2 x^3\ d_1' - \tfrac{11x^3 d_1'}{9} - \tfrac{7}{36}\pi^2 x^2 d_1' + \tfrac{1195\ x^2 d_1'}{144} + \tfrac{11}{18}\pi^2 x d_1' - \tfrac{5831x\ d_1'}{72} - \tfrac{\pi^2 x^3}{3} + 5x^3 + \tfrac{53\pi^2\ x^2}{36} - \tfrac{1169x^2}{48} - \tfrac{73\pi^2 x}{18} + \tfrac{1139x}{8} + \Big(-\tfrac{1}{27} x^3 d_1'^3 + \tfrac{17x^2 d_1'^3}{72} - \tfrac{49x\ d_1'^3}{36} + \tfrac{251 d_1'^3}{216} + \tfrac{11x^3 d_1'^2}{27} - \tfrac{173\ x^2 d_1'^2}{72} + \tfrac{481 x d_1'^2}{36} - \tfrac{2455\ d_1'^2}{216} + \tfrac{1}{9}\pi^2 x^3 d_1' - \tfrac{17x^3\ d_1'}{9} - \tfrac{1}{2}\pi^2 x^2 d_1' + \tfrac{571 x^2 d_1'}{72} + \pi^2 x\ d_1' - \tfrac{1013 x d_1'}{36} - \tfrac{11\pi^2 d_1'}{18} + \tfrac{1591\ d_1'}{72} + \tfrac{\pi^2 x^3}{9} - \tfrac{7x^3}{3} - \tfrac{\pi^2\ x^2}{2} + \tfrac{307x^2}{24} + \pi^2 x - \tfrac{191x}{4} - \tfrac{11\pi^{\ 2}}{18} + \tfrac{895}{24}\Big)H(1;x) + \Big(-\tfrac{16 d_1' x^3}{9} + 16\ x^3 + \tfrac{28 d_1' x^2}{3} - \tfrac{212x^2}{3} - \tfrac{88 d_1'\ x}{3} + \tfrac{584x}{3} - \tfrac{4\pi^2}{3}\Big)\ H(0,0;x) + \Big(-\tfrac{4}{9} d_1'^2 x^3 + \tfrac{34 d_1' x^3}{9} + 2\ x^3 + \tfrac{7d_1'^2 x^2}{3} - \tfrac{33 d_1' x^2}{2} - \tfrac{19\ x^2}{2} - \tfrac{22 d_1'^2 x}{3} + 45 d_1' x + 26x - \tfrac{d_1' \pi^{\ 2}}{3} - \tfrac{\pi^2}{3} + 4\Big)H(0,1;x) + \Big(-\tfrac{4}{9} d_1'^2 x^3 + \tfrac{32 d_1' x^3}{9} + 4x^3 + \tfrac{7d_1'^2 x^2}{3} - \tfrac{46 d_1'\ x^2}{3} - \tfrac{61x^2}{3} - \tfrac{22 d_1'^2 x}{3} + \tfrac{124 d_1'\ x}{3} + \tfrac{166x}{3} + \tfrac{49 d_1'^2}{9} - \tfrac{266 d_1'}{9} - 39\Big)\ H(1,0;x) + \Big(-\tfrac{1}{9} x^3 d_1'^3 + \tfrac{7x^2\ d_1'^3}{12} - \tfrac{11 x d_1'^3}{6} + \tfrac{49 d_1'^3}{36} + \tfrac{7x^3\ d_1'^2}{9} - \tfrac{13x^2 d_1'^2}{4} + \tfrac{17 x d_1'^2}{2} - \tfrac{217\ d_1'^2}{36} + \tfrac{19x^3 d_1'}{9} - \tfrac{43x^2 d_1'}{4} + \tfrac{59x\ d_1'}{2} - \tfrac{751 d_1'}{36} - x^3 + \tfrac{61x^2}{12} - \tfrac{83\ x}{6} + \tfrac{39}{4}\Big)H(1,1;x) + \Big(-\tfrac{64x^3}{3} + 96x^2 - 192\ x\Big)H(0,0,0;x) + \Big(-\tfrac{16 d_1' x^3}{3} - 2x^3 + 24 d_1' x^2 + 9\ x^2 - 48 d_1' x - 18x - 2\Big)H(0,0,1;x) + \Big(-\tfrac{16 d_1'\ x^3}{3} - \tfrac{8x^3}{3} + 24 d_1' x^2 + 12x^2 - 48 d_1' x - 24x - 8\Big)\ H(0,1,0;x) + \Big(-\tfrac{4}{3} d_1'^2 x^3 - \tfrac{4 d_1' x^3}{3} + \tfrac{2\ x^3}{3} + 6 d_1'^2 x^2 + 6 d_1' x^2 - 3x^2 - 12 d_1'^2 x - 12 d_1' x + 6x - 4\ d_1' + 2\Big)H(0,1,1;x) + \Big(-\tfrac{16 d_1' x^3}{3} - \tfrac{16\ x^3}{3} + 24 d_1' x^2 + 24x^2 - 48 d_1' x - 48x + \tfrac{88\ d_1'}{3} + \tfrac{88}{3}\Big)H(1,0,0;x) + \Big(-\tfrac{4}{3} d_1'^2 x^3 - 2\ d_1' x^3 + 6 d_1'^2 x^2 + 9 d_1' x^2 - 12 d_1'^2 x - 18 d_1' x + \tfrac{22\ d_1'^2}{3} + 11 d_1'\Big)H(1,0,1;x) + \Big(-\tfrac{4}{3} d_1'^2\ x^3 - \tfrac{8 d_1' x^3}{3} + \tfrac{4x^3}{3} + 6 d_1'^2 x^2 + 12 d_1' x^2 - 6\ x^2 - 12 d_1'^2 x - 24 d_1' x + 12x + \tfrac{22 d_1'^2}{3} + \tfrac{44 d_1'}{3} - \tfrac{22}{3}\Big)H(1,1,0;x) + \Big(-\tfrac{1}{3} x^3 d_1'^3 +$$

$\frac{3x^2\, d_1'^3}{2} - 3xd_1'^3 + \frac{11d_1'^3}{6} - x^3 d_1'^2 + \frac{9x^2\, d_1'^2}{2} - 9xd_1'^2 + \frac{11d_1'^2}{2} + x^3 d_1' - \frac{9x^2\, d_1'}{2} + 9xd_1' - \frac{11d_1'}{2} - \frac{x^3}{3} + \frac{3x^2}{2} - 3\, x + \frac{11}{6}\Big) H(1,1,1;x) + 64H(0,0,0,0;x) + (16d_1' + 6)\, H(0,0,0,1;x) + (16d_1' + 8)H(0,0,1,0;x) + \Big(4d_1'^2 + 4d_1' - 2\Big)\, H(0,0,1,1;x) + (16d_1' + 16)H(0,1,0,0;x) + \Big(4d_1'^2 + 6d_1'\Big)\, H(0,1,0,1;x) + \Big(4d_1'^2 + 8d_1' - 4\Big) H(0,1,1,0;x) + \Big(d_1'^3 + 3\, d_1'^2 - 3d_1' + 1\Big) H(0,1,1,1;x) + H(0;x)\Big(-\frac{4}{27} d_1'^2\, x^3 + \frac{16d_1' x^3}{9} + \frac{4\pi^2 x^3}{9} - \frac{28\, x^3}{3} + \frac{17d_1'^2 x^2}{18} - \frac{95d_1' x^2}{9} - 2\pi^2\, x^2 + \frac{259x^2}{6} - \frac{49d_1'^2 x}{9} + \frac{530d_1' x}{9} + 4\, \pi^2 x - \frac{515x}{3} + 6\zeta_3\Big) - 2x^3\zeta_3 + 9x^2\, \zeta_3 - 18x\zeta_3 - \frac{11\pi^4}{360}.$

D. The $\mathcal{A}$-type collinear integrals

D.1 The $\mathcal{A}$ integral for $k = 0$ and arbitrary κ

The ε expansion for this integral reads

$$\begin{aligned} \mathcal{I}(x, \varepsilon; \alpha_0, 3 + d_1\varepsilon; \kappa, 0, 0, g_A) &= x\, \mathcal{A}(\varepsilon, x; 3 + d_1\varepsilon; \kappa, 2) \\ &= \frac{1}{\varepsilon} a_{-1}^{(\kappa,0)} + a_0^{(\kappa,0)} + \varepsilon a_1^{(\kappa,0)} + \varepsilon^2 a_2^{(\kappa,0)} + \mathcal{O}\left(\varepsilon^3\right), \end{aligned} \tag{D.1}$$

where

$a_{-1}^{(\kappa,0)} = -\frac{1}{(\kappa+1)},$

$a_0^{(\kappa,0)} = \frac{\alpha_0^4}{4(x-1)} + \frac{\kappa\alpha_0^4}{4(\kappa\, +1)} + \frac{\alpha_0^4}{4(\kappa+1)} - \frac{\alpha_0^3}{x-1} - \frac{4\kappa\, \alpha_0^3}{3(\kappa+1)} - \frac{4\alpha_0^3}{3(\kappa+1)} + \frac{\alpha_0^3}{3\, (x-1)^2} + \frac{3\alpha_0^2}{2(x-1)} + \frac{3\kappa\alpha_0^2}{\kappa\, +1} + \frac{3\alpha_0^2}{\kappa+1} - \frac{\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{2\, (x-1)^3} - \frac{\alpha_0}{x-1} - \frac{4\kappa\alpha_0}{\kappa+1} - \frac{4\, \alpha_0}{\kappa\, +1} + \frac{\alpha_0}{(x-1)^2} - \frac{\alpha_0}{(x-1)^3} + \frac{\alpha_0}{(x-1)^4} + \Big(\, 1 + \frac{1}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(1 - \frac{1}{(x-1)^5}\Big)\, H(0;x) + \frac{H(c_1(\alpha_0);x)}{(x-1)^5} - \frac{2}{\kappa+1},$

$a_1^{(\kappa,0)} = -\frac{d_1\alpha_0^4}{8(\kappa+1)} - \frac{d_1\kappa\alpha_0^4}{8(\kappa\, +1)} - \frac{d_1\kappa\alpha_0^4}{8(x-1)(\kappa+1)} + \frac{7\kappa\, \alpha_0^4}{8(x-1)(\kappa+1)} + \frac{7\kappa\alpha_0^4}{8(\kappa\, +1)} - \frac{d_1\alpha_0^4}{8(x-1)(\kappa+1)} + \frac{5\alpha_0^4}{8(x-1)\, (\kappa+1)} + \frac{5\alpha_0^4}{8(\kappa+1)} + \frac{13d_1\alpha_0^3}{18\, (\kappa+1)} + \frac{13d_1\kappa\alpha_0^3}{18(\kappa+1)} + \frac{d_1\, \kappa\alpha_0^3}{2(x-1)(\kappa+1)} - \frac{7\kappa\alpha_0^3}{2(x-1)\, (\kappa+1)} - \frac{2d_1\kappa\alpha_0^3}{9(x-1)^2(\kappa\, +1)} + \frac{19\kappa\alpha_0^3}{12(x-1)^2(\kappa+1)} - \frac{61\kappa\, \alpha_0^3}{12(\kappa+1)} + \frac{d_1\alpha_0^3}{2(x-1)(\kappa+1)} - \frac{5\, \alpha_0^3}{2(x-1)(\kappa+1)} - \frac{2d_1\alpha_0^3}{9(x-1)^2(\kappa\, +1)} + \frac{35\alpha_0^3}{36(x-1)^2(\kappa+1)} - \frac{125\alpha_0^3}{36\, (\kappa+1)} - \frac{23d_1\alpha_0^2}{12(\kappa+1)} - \frac{23d_1\kappa\, \alpha_0^2}{12(\kappa+1)} - \frac{3d_1\kappa\alpha_0^2}{4(x-1)(\kappa\, +1)} + \frac{41\kappa\alpha_0^2}{8(x-1)(\kappa+1)} + \frac{2d_1\kappa\, \alpha_0^2}{3(x-1)^2(\kappa+1)} - \frac{39\kappa\alpha_0^2}{8(x-1)^2\, (\kappa+1)} - \frac{d_1\kappa\alpha_0^2}{2(x-1)^3(\kappa+1)} + \frac{27\, \kappa\alpha_0^2}{8(x-1)^3(\kappa+1)} + \frac{107\kappa\alpha_0^2}{8\, (\kappa+1)} - \frac{3d_1\alpha_0^2}{4(x-1)(\kappa+1)} + \frac{89\, \alpha_0^2}{24(x-1)(\kappa+1)} + \frac{2d_1\alpha_0^2}{3(x-1)^2(\kappa\, +1)} - \frac{71\alpha_0^2}{24(x-1)^2(\kappa+1)} - \frac{d_1\alpha_0^2}{2\, (x-1)^3(\kappa+1)} + \frac{43\alpha_0^2}{24(x-1)^3(\kappa\, +1)} + \frac{203\alpha_0^2}{24(\kappa+1)} + \frac{25d_1\alpha_0}{6(\kappa\, +1)} + \frac{25d_1\kappa\alpha_0}{6(\kappa+1)} + \frac{d_1\kappa\, \alpha_0}{2(x-1)(\kappa+1)} - \frac{5\kappa\alpha_0}{2(x-1)(\kappa\, +1)} - \frac{2d_1\kappa\alpha_0}{3(x-1)^2(\kappa+1)} + \frac{5\kappa\, \alpha_0}{(x-1)^2(\kappa+1)} + \frac{d_1\kappa\alpha_0}{(x-1)^3(\kappa\, +1)} - \frac{15\kappa\alpha_0}{2(x-1)^3(\kappa+1)} - \frac{2d_1\kappa\, \alpha_0}{(x-1)^4(\kappa+1)} + \frac{45\kappa\alpha_0}{4(x-1)^4(\kappa\, +1)} - \frac{105\kappa\alpha_0}{4(\kappa+1)} + \frac{d_1\alpha_0}{2(x-1)\, (\kappa+1)} - \frac{13\alpha_0}{6(x-1)(\kappa+1)} - \frac{2d_1\alpha_0}{3\, (x-1)^2(\kappa+1)} + \frac{3\alpha_0}{(x-1)^2(\kappa+1)} + \frac{d_1\, \alpha_0}{(x-1)^3(\kappa+1)} - \frac{23\alpha_0}{6(x-1)^3(\kappa\, +1)} - \frac{2d_1\alpha_0}{(x-1)^4(\kappa+1)} + \frac{61\alpha_0}{12(x-1)^4(\, \kappa+1)} - \frac{169\alpha_0}{12(\kappa+1)} + \Big(-\frac{\kappa\, \alpha_0^4}{2(x-1)} - \frac{\kappa\alpha_0^4}{2} - \frac{\alpha_0^4}{2\, (x-1)} - \frac{\alpha_0^4}{2} + \frac{2\kappa\alpha_0^3}{x-1} - \frac{2\kappa\, \alpha_0^3}{3(x-1)^2} + \frac{8\kappa\alpha_0^3}{3} + \frac{2\, \alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} - \frac{3\, \kappa\alpha_0^2}{x-1} + \frac{2\kappa\alpha_0^2}{(x-1)^2} - \frac{\kappa\, \alpha_0^2}{(x-1)^3} - 6\kappa\alpha_0^2 - \frac{3\alpha_0^2}{x-1} + \frac{2\, \alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} - 6\alpha_0^2 + \frac{2\kappa\, \alpha_0}{x-1} - \frac{2\kappa\alpha_0}{(x-1)^2} + \frac{2\kappa\, \alpha_0}{(x-1)^3} - \frac{2\kappa\alpha_0}{(x-1)^4} + 8\kappa\alpha_0 + \frac{2\, \alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\alpha_0}{(x-1)^3} - \frac{2\, \alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{5\kappa}{4(x-1)} + \frac{5\kappa}{6\, (x-1)^2} - \frac{5\kappa}{6(x-1)^3} + \frac{5\kappa}{4\, (x-1)^4} + \frac{25\kappa}{12(x-1)^5} - \frac{25\kappa}{12} - \frac{5}{4(x-1)} + \frac{5}{6(x-1)^2} - \frac{5}{6\, (x-1)^3} + \frac{5}{4(x-1)^4} + \frac{49}{12(x-1)^5} - \frac{1}{12}\Big)\, H(0;\alpha_0) + \Big(\frac{5\kappa}{4(x-1)} - \frac{5\kappa}{6\, (x-1)^2} + \frac{5\kappa}{6(x-1)^3} - \frac{5\kappa}{4\, (x-1)^4} - \frac{25\kappa}{12(x-1)^5} + \frac{25\kappa}{12} + \frac{5}{4(x-1)} - \frac{5}{6(x-1)^2} + \frac{5}{6\, (x-1)^3} - \frac{5}{4(x-1)^4} - \frac{49}{12(x-1)^5} + \frac{49}{12}\Big)\, H(0;x) + \Big(-\frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8\, d_1\alpha_0^3}{3} + \frac{2d_1\alpha_0^3}{x-1} - \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6\, d_1\alpha_0^2 - \frac{3d_1\alpha_0^2}{x-1} + \frac{2d_1\, \alpha_0^2}{(x-1)^2} - \frac{d_1\alpha_0^2}{(x-1)^3} + 8d_1\alpha_0 + \frac{2d_1\, \alpha_0}{x-1} - \frac{2d_1\alpha_0}{(x-1)^2} + \frac{2d_1\alpha_0}{(x-1)^3} - \frac{2\, d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{d_1}{2(x-1)} + \frac{2d_1}{3\, (x-1)^2} - \frac{d_1}{(x-1)^3} + \frac{2d_1}{(x-1)^4}\Big)\, H(1;\alpha_0) + \Big(\frac{2d_1}{(x-1)^5} - \frac{\kappa}{(x-1)^5} + \kappa\, - \frac{1}{(x-1)^5} + 1\Big) H(0;\alpha_0)H(1;x) + \Big(-\frac{\kappa\, \alpha_0^4}{4(x-1)} - \frac{\kappa\alpha_0^4}{4} - \frac{\alpha_0^4}{4\, (x-1)} - \frac{\alpha_0^4}{4} + \frac{\kappa\alpha_0^3}{x-1} - \frac{\kappa\, \alpha_0^3}{3(x-1)^2} +$

$$\frac{4\kappa\alpha_0^3}{3}+\frac{\alpha_0^3}{x-1}-\frac{\alpha_0^3}{3(x-1)^2}+\frac{4\alpha_0^3}{3}-\frac{3\kappa\alpha_0^2}{2(x-1)}+\frac{\kappa\alpha_0^2}{(x-1)^2}-\frac{\kappa\alpha_0^2}{2(x-1)^3}-3\kappa\alpha_0^2-\frac{3\alpha_0^2}{2(x-1)}+\frac{\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{2(x-1)^3}-3\alpha_0^2+$$
$$\frac{\kappa\alpha_0}{x-1}-\frac{\kappa\alpha_0}{(x-1)^2}+\frac{\kappa\alpha_0}{(x-1)^3}-\frac{\kappa\alpha_0}{(x-1)^4}+4\kappa\alpha_0+\frac{\alpha_0}{x-1}-\frac{\alpha_0}{(x-1)^2}+\frac{\alpha_0}{(x-1)^3}-\frac{\alpha_0}{}(x-1)^4+4\alpha_0-\frac{5\kappa}{4(x-1)}+\frac{5\kappa}{6(x-1)^2}-$$
$$\frac{5\kappa}{6(x-1)^3}+\frac{5\kappa}{4(x-1)^4}+\frac{25\kappa}{12(x-1)^5}-\frac{25\kappa}{12}+\left(-\frac{2\kappa}{(x-1)^5}-\frac{2}{(x-1)^5}\right)H(0;\alpha_0)-\frac{2d_1H(1;\alpha_0)}{(x-1)^5}-\frac{5}{4(x-1)}+\frac{5}{6(x-1)^2}-$$
$$\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}+\frac{49}{12(x-1)^5}-\frac{25}{12}\Big)H(c_1(\alpha_0);x)+\Big(-\frac{2\kappa}{(x-1)^5}-2\kappa-\frac{2}{(x-1)^5}-2\Big)H(0,0;\alpha_0)+\Big(\frac{2\kappa}{(x-1)^5}-$$
$$2\kappa+\frac{2}{(x-1)^5}-2\Big)H(0,0;x)+\Big(-\frac{2d_1}{(x-1)^5}-2d_1\Big)H(0,1;\alpha_0)+\Big(-\frac{\kappa}{(x-1)^5}+\kappa-\frac{1}{(x-1)^5}+1\Big)H(0,c_1(\alpha_0);x)+$$
$$\Big(-\frac{2d_1}{(x-1)^5}+\frac{\kappa}{(x-1)^5}-\kappa+\frac{1}{(x-1)^5}-1\Big)H(1,0;x)+\Big(\frac{2d_1}{(x-1)^5}-\frac{\kappa}{(x-1)^5}+\kappa-\frac{1}{(x-1)^5}+1\Big)H(1,c_1(\alpha_0);x)+$$
$$\Big(-\frac{\kappa}{(x-1)^5}-\frac{1}{(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\frac{\pi^2\kappa}{2(x-1)^5(\kappa+1)}-\frac{\pi^2\kappa}{2(\kappa+1)}+\frac{\pi^2}{6(x-1)^5(\kappa+1)}-\frac{4}{\kappa+1},$$

$$a_2^{(\kappa,0)}=$$
$$\frac{d_1^2\alpha_0^4}{16(\kappa+1)}-\frac{3d_1\alpha_0^4}{8(\kappa+1)}+\frac{d_1^2\kappa\alpha_0^4}{16(\kappa+1)}-\frac{5d_1\kappa\alpha_0^4}{8(\kappa+1)}+\frac{d_1^2\kappa\alpha_0^4}{16(x-1)(\kappa+1)}-\frac{5d_1\kappa\alpha_0^4}{8(x-1)(\kappa+1)}-\frac{\pi^2\kappa\alpha_0^4}{24(x-1)(\kappa+1)}+\frac{35\kappa\alpha_0^4}{16(x-1)(\kappa+1)}+$$
$$\frac{35\kappa\alpha_0^4}{16(\kappa+1)}+\frac{d_1^2\alpha_0^4}{16(x-1)(\kappa+1)}-\frac{3d_1\alpha_0^4}{8(x-1)(\kappa+1)}-\frac{\pi^2\alpha_0^4}{24(x-1)(\kappa+1)}+\frac{21\alpha_0^4}{16(x-1)(\kappa+1)}+\frac{21\alpha_0^4}{16(\kappa+1)}-\frac{\pi^2\alpha_0^4}{24}-\frac{43d_1^2\alpha_0^3}{108(\kappa+1)}+$$
$$\frac{505d_1\alpha_0^3}{216(\kappa+1)}-\frac{43d_1^2\kappa\alpha_0^3}{108(\kappa+1)}+\frac{33d_1\kappa\alpha_0^3}{8(\kappa+1)}-\frac{d_1^2\kappa\alpha_0^3}{4(x-1)(\kappa+1)}+\frac{5d_1\kappa\alpha_0^3}{2(x-1)(\kappa+1)}+\frac{\pi^2\kappa\alpha_0^3}{6(x-1)(\kappa+1)}-\frac{35\kappa\alpha_0^3}{4(x-1)(\kappa+1)}+\frac{4d_1^2\kappa\alpha_0^3}{27(x-1)^2(\kappa+1)}-$$
$$\frac{13d_1\kappa\alpha_0^3}{8(x-1)^2(\kappa+1)}-\frac{\pi^2\kappa\alpha_0^3}{18(x-1)^2(\kappa+1)}+\frac{1055\kappa\alpha_0^3}{216(x-1)^2(\kappa+1)}-\frac{2945\kappa\alpha_0^3}{216(\kappa+1)}-\frac{d_1^2\alpha_0^3}{4(x-1)(\kappa+1)}+\frac{3d_1\alpha_0^3}{2(x-1)(\kappa+1)}+\frac{\pi^2\alpha_0^3}{6(x-1)(\kappa+1)}-$$
$$\frac{21\alpha_0^3}{4(x-1)(\kappa+1)}+\frac{4d_1^2\alpha_0^3}{27(x-1)^2(\kappa+1)}-\frac{181d_1\alpha_0^3}{216(x-1)^2(\kappa+1)}-\frac{\pi^2\alpha_0^3}{18(x-1)^2(\kappa+1)}+\frac{473\alpha_0^3}{216(x-1)^2(\kappa+1)}-\frac{1607\alpha_0^3}{216(\kappa+1)}+\frac{2\pi^2\alpha_0^3}{9}+$$
$$\frac{95d_1^2\alpha_0^2}{72(\kappa+1)}-\frac{347d_1\alpha_0^2}{48(\kappa+1)}+\frac{95d_1^2\kappa\alpha_0^2}{72(\kappa+1)}-\frac{673d_1\kappa\alpha_0^2}{48(\kappa+1)}+\frac{3d_1^2\kappa\alpha_0^2}{8(x-1)(\kappa+1)}-\frac{167d_1\kappa\alpha_0^2}{48(x-1)(\kappa+1)}-\frac{\pi^2\kappa\alpha_0^2}{4(x-1)(\kappa+1)}+\frac{1721\kappa\alpha_0^2}{144(x-1)(\kappa+1)}-$$
$$\frac{4d_1^2\kappa\alpha_0^2}{9(x-1)^2(\kappa+1)}+\frac{247d_1\kappa\alpha_0^2}{48(x-1)^2(\kappa+1)}+\frac{\pi^2\kappa\alpha_0^2}{6(x-1)^2(\kappa+1)}-\frac{2279\kappa\alpha_0^2}{144(x-1)^2(\kappa+1)}+\frac{d_1^2\kappa\alpha_0^2}{2(x-1)^3(\kappa+1)}-\frac{259d_1\kappa\alpha_0^2}{48(x-1)^3(\kappa+1)}-$$
$$\frac{\pi^2\kappa\alpha_0^2}{12(x-1)^3(\kappa+1)}+\frac{1987\kappa\alpha_0^2}{144(x-1)^3(\kappa+1)}+\frac{5987\kappa\alpha_0^2}{144(\kappa+1)}+\frac{3d_1^2\alpha_0^2}{8(x-1)(\kappa+1)}-\frac{311d_1\alpha_0^2}{144(x-1)(\kappa+1)}-\frac{\pi^2\alpha_0^2}{4(x-1)(\kappa+1)}+\frac{1103\alpha_0^2}{144(x-1)(\kappa+1)}-$$
$$\frac{4d_1^2\alpha_0^2}{9(x-1)^2(\kappa+1)}+\frac{125d_1\alpha_0^2}{48(x-1)^2(\kappa+1)}+\frac{\pi^2\alpha_0^2}{6(x-1)^2(\kappa+1)}-\frac{977\alpha_0^2}{144(x-1)^2(\kappa+1)}+\frac{d_1^2\alpha_0^2}{2(x-1)^3(\kappa+1)}-\frac{355d_1\alpha_0^2}{144(x-1)^3(\kappa+1)}-$$
$$\frac{\pi^2\alpha_0^2}{12(x-1)^3(\kappa+1)}+\frac{661\alpha_0^2}{144(x-1)^3(\kappa+1)}+\frac{2741\alpha_0^2}{144(\kappa+1)}-\frac{\pi^2\alpha_0^2}{2}-\frac{205d_1^2\alpha_0}{36(\kappa+1)}+\frac{575d_1\alpha_0}{24(\kappa+1)}-\frac{205d_1^2\kappa\alpha_0}{36(\kappa+1)}+\frac{1325d_1\kappa\alpha_0}{24(\kappa+1)}-$$
$$\frac{d_1^2\kappa\alpha_0}{4(x-1)(\kappa+1)}-\frac{2d_1\kappa\alpha_0}{3(x-1)(\kappa+1)}+\frac{\pi^2\kappa\alpha_0}{6(x-1)(\kappa+1)}+\frac{32\kappa\alpha_0}{9(x-1)(\kappa+1)}+\frac{4d_1^2\kappa\alpha_0}{9(x-1)^2(\kappa+1)}-\frac{65d_1\kappa\alpha_0}{12(x-1)^2(\kappa+1)}-\frac{\pi^2\kappa\alpha_0}{6(x-1)^2(\kappa+1)}+$$
$$\frac{17\kappa\alpha_0}{(x-1)^2(\kappa+1)}-\frac{d_1^2\kappa\alpha_0}{(x-1)^3(\kappa+1)}+\frac{161d_1\kappa\alpha_0}{12(x-1)^3(\kappa+1)}+\frac{\pi^2\kappa\alpha_0}{6(x-1)^3(\kappa+1)}-\frac{338\kappa\alpha_0}{9(x-1)^3(\kappa+1)}+\frac{4d_1^2\kappa\alpha_0}{(x-1)^4(\kappa+1)}-\frac{889d_1\kappa\alpha_0}{24(x-1)^4(\kappa+1)}-$$
$$\frac{\pi^2\kappa\alpha_0}{6(x-1)^4(\kappa+1)}+\frac{668\kappa\alpha_0}{9(x-1)^4(\kappa+1)}-\frac{1127\kappa\alpha_0}{9(\kappa+1)}-\frac{d_1^2\alpha_0}{4(x-1)(\kappa+1)}+\frac{4d_1\alpha_0}{9(x-1)(\kappa+1)}+\frac{\pi^2\alpha_0}{6(x-1)(\kappa+1)}-\frac{28\alpha_0}{9(x-1)(\kappa+1)}+$$
$$\frac{4d_1^2\alpha_0}{9(x-1)^2(\kappa+1)}-\frac{97d_1\alpha_0}{36(x-1)^2(\kappa+1)}-\frac{\pi^2\alpha_0}{6(x-1)^2(\kappa+1)}+\frac{7\alpha_0}{(x-1)^2(\kappa+1)}-\frac{d_1^2\alpha_0}{(x-1)^3(\kappa+1)}+\frac{209d_1\alpha_0}{36(x-1)^3(\kappa+1)}+\frac{\pi^2\alpha_0}{6(x-1)^3(\kappa+1)}-$$
$$\frac{98\alpha_0}{9(x-1)^3(\kappa+1)}+\frac{4d_1^2\alpha_0}{(x-1)^4(\kappa+1)}-\frac{1081d_1\alpha_0}{72(x-1)^4(\kappa+1)}-\frac{\pi^2\alpha_0}{6(x-1)^4(\kappa+1)}+\frac{158\alpha_0}{9(x-1)^4(\kappa+1)}-\frac{347\alpha_0}{9(\kappa+1)}+\frac{2\pi^2\alpha_0}{3}+\Big(\frac{d_1\alpha_0^4}{4}+$$
$$\frac{1}{4}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{4(x-1)}-\frac{7\kappa\alpha_0^4}{4(x-1)}-\frac{7\kappa\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{5\alpha_0^4}{4(x-1)}-\frac{5\alpha_0^4}{4}-\frac{13d_1\alpha_0^3}{9}-\frac{13}{9}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{x-1}+\frac{7\kappa\alpha_0^3}{x-1}+\frac{4d_1\kappa\alpha_0^3}{9(x-1)^2}-$$
$$\frac{19\kappa\alpha_0^3}{6(x-1)^2}+\frac{61\kappa\alpha_0^3}{6}-\frac{d_1\alpha_0^3}{x-1}+\frac{5\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{9(x-1)^2}-\frac{35\alpha_0^3}{18(x-1)^2}+\frac{125\alpha_0^3}{18}+\frac{23d_1\alpha_0^2}{6}+\frac{23}{6}d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{2(x-1)}-\frac{41\kappa\alpha_0^2}{4(x-1)}-$$
$$\frac{4d_1\kappa\alpha_0^2}{3(x-1)^2}+\frac{39\kappa\alpha_0^2}{4(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}-\frac{27\kappa\alpha_0^2}{4(x-1)^3}-\frac{107\kappa\alpha_0^2}{4}+\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{89\alpha_0^2}{12(x-1)}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{71\alpha_0^2}{12(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-$$
$$\frac{43\alpha_0^2}{12(x-1)^3}-\frac{203\alpha_0^2}{12}-\frac{25d_1\alpha_0}{3}-\frac{25d_1\kappa\alpha_0}{3}-\frac{d_1\kappa\alpha_0}{x-1}+\frac{5\kappa\alpha_0}{x-1}+\frac{4d_1\kappa\alpha_0}{3(x-1)^2}-\frac{10\kappa\alpha_0}{(x-1)^2}-\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{15\kappa\alpha_0}{(x-1)^3}+\frac{4d_1\kappa\alpha_0}{(x-1)^4}-$$
$$\frac{45\kappa\alpha_0}{2(x-1)^4}+\frac{105\kappa\alpha_0}{2}-\frac{d_1\alpha_0}{x-1}+\frac{13\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{6\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{23\alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{61\alpha_0}{6(x-1)^4}+\frac{169\alpha_0}{6}+\frac{205d_1}{72}+$$
$$\frac{205d_1\kappa}{72}+\frac{17d_1\kappa}{8(x-1)}-\frac{45\kappa}{4(x-1)}-\frac{13d_1\kappa}{18(x-1)^2}+\frac{35\kappa}{6(x-1)^2}+\frac{13d_1\kappa}{18(x-1)^3}-\frac{35\kappa}{6(x-1)^3}-\frac{17d_1\kappa}{8(x-1)^4}+\frac{45\kappa}{4(x-1)^4}-\frac{205d_1\kappa}{72(x-1)^5}+$$
$$\frac{205\kappa}{12(x-1)^5}-\frac{205\kappa}{12}+\frac{17d_1}{8(x-1)}-\frac{65}{12(x-1)}-\frac{13d_1}{18(x-1)^2}+\frac{55}{18(x-1)^2}+\frac{13d_1}{18(x-1)^3}-\frac{55}{18(x-1)^3}-\frac{17d_1}{8(x-1)^4}+\frac{65}{12(x-1)^4}-$$
$$\frac{205d_1}{72(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+\frac{449}{36(x-1)^5}-\frac{\pi^2}{6}-\frac{161}{36}\Big)H(0;\alpha_0)+\Big(-\frac{17\kappa d_1}{8(x-1)}+\frac{13\kappa d_1}{18(x-1)^2}-\frac{13\kappa d_1}{18(x-1)^3}+\frac{17\kappa d_1}{8(x-1)^4}+\frac{205\kappa d_1}{72(x-1)^5}-$$
$$\frac{205\kappa d_1}{72}-\frac{17d_1}{8(x-1)}+\frac{13d_1}{18(x-1)^2}-\frac{13d_1}{18(x-1)^3}+\frac{17d_1}{8(x-1)^4}+\frac{205d_1}{72(x-1)^5}-\frac{205d_1}{72}+\frac{45\kappa}{4(x-1)}-\frac{35\kappa}{6(x-1)^2}+\frac{35\kappa}{6(x-1)^3}-$$
$$\frac{45\kappa}{4(x-1)^4}-\frac{\pi^2\kappa}{(x-1)^5}-\frac{205\kappa}{12(x-1)^5}+\pi^2\kappa+\frac{205\kappa}{12}+\frac{65}{12(x-1)}-\frac{55}{18(x-1)^2}+\frac{55}{18(x-1)^3}-\frac{65}{12(x-1)^4}-\frac{\pi^2}{6(x-1)^5}-\frac{449}{36(x-1)^5}+$$

$$\frac{\pi^2}{6}+\frac{449}{36}\Big)H(0;x)+\Big(\frac{d_1^2\alpha_0^4}{4}-\frac{5d_1\alpha_0^4}{4}-\frac{1}{4}d_1\kappa\alpha_0^4-\frac{d_1\kappa\alpha_0^4}{4(x-1)}+\frac{d_1^2\alpha_0^4}{4(x-1)}-\frac{5d_1\alpha_0^4}{4(x-1)}-\frac{13d_1^2\alpha_0^3}{9}+\frac{125d_1\alpha_0^3}{18}+\frac{29}{18}d_1\kappa\alpha_0^3+$$

$$\frac{d_1\kappa\alpha_0^3}{x-1}-\frac{11d_1\kappa\alpha_0^3}{18(x-1)^2}-\frac{d_1^2\alpha_0^3}{x-1}+\frac{5d_1\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{9(x-1)^2}-\frac{35d_1\alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-\frac{203d_1\alpha_0^2}{12}-\frac{59}{12}d_1\kappa\alpha_0^2-\frac{17d_1\kappa\alpha_0^2}{12(x-1)}+$$

$$\frac{23d_1\kappa\alpha_0^2}{12(x-1)^2}-\frac{19d_1\kappa\alpha_0^2}{12(x-1)^3}+\frac{3d_1^2\alpha_0^2}{2(x-1)}-\frac{89d_1\alpha_0^2}{12(x-1)}-\frac{4d_1^2\alpha_0^2}{3(x-1)^2}+\frac{71d_1\alpha_0^2}{12(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-\frac{43d_1\alpha_0^2}{12(x-1)^3}-\frac{25d_1^2\alpha_0}{3}+\frac{169d_1\alpha_0}{6}+$$

$$\frac{73d_1\kappa\alpha_0}{6}+\frac{d_1\kappa\alpha_0}{3(x-1)}-\frac{2d_1\kappa\alpha_0}{(x-1)^2}+\frac{11d_1\kappa\alpha_0}{3(x-1)^3}-\frac{37d_1\kappa\alpha_0}{6(x-1)^4}-\frac{d_1^2\alpha_0}{x-1}+\frac{13d_1\alpha_0}{3(x-1)}+\frac{4d_1^2\alpha_0}{3(x-1)^2}-\frac{6d_1\alpha_0}{(x-1)^2}-\frac{2d_1^2\alpha_0}{(x-1)^3}+\frac{23d_1\alpha_0}{3(x-1)^3}+$$

$$\frac{4d_1^2\alpha_0}{(x-1)^4}-\frac{61d_1\alpha_0}{6(x-1)^4}+\frac{205d_1^2}{36}-\frac{305d_1}{18}-\frac{155d_1\kappa}{18}+\frac{d_1\kappa}{3(x-1)}+\frac{25d_1\kappa}{36(x-1)^2}-\frac{25d_1\kappa}{12(x-1)^3}+\frac{37d_1\kappa}{6(x-1)^4}+\frac{d_1^2}{4(x-1)}-\frac{2d_1}{3(x-1)}-$$

$$\frac{4d_1^2}{9(x-1)^2}+\frac{73d_1}{36(x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{49d_1}{12(x-1)^3}-\frac{4d_1^2}{(x-1)^4}+\frac{61d_1}{6(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{3\kappa\alpha_0^4}{x-1}+3\kappa\alpha_0^4+\frac{\alpha_0^4}{x-1}+\alpha_0^4-\frac{12\kappa\alpha_0^3}{x-1}+$$

$$\frac{4\kappa\alpha_0^3}{(x-1)^2}-16\kappa\alpha_0^3-\frac{4\alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}+\frac{18\kappa\alpha_0^2}{x-1}-\frac{12\kappa\alpha_0^2}{(x-1)^2}+\frac{6\kappa\alpha_0^2}{(x-1)^3}+36\kappa\alpha_0^2+\frac{6\alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2-$$

$$\frac{12\kappa\alpha_0}{x-1}+\frac{12\kappa\alpha_0}{(x-1)^2}-\frac{12\kappa\alpha_0}{(x-1)^3}+\frac{12\kappa\alpha_0}{(x-1)^4}-48\kappa\alpha_0-\frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\alpha_0}{(x-1)^4}-16\alpha_0+\frac{15\kappa}{2(x-1)}-\frac{5\kappa}{(x-1)^2}+$$

$$\frac{5\kappa}{(x-1)^3}-\frac{15\kappa}{2(x-1)^4}-\frac{33\kappa}{2(x-1)^5}+\frac{17\kappa}{2}+\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}-\frac{49}{6(x-1)^5}+\frac{1}{6}\Big)H(0,0;\alpha_0)+\Big(-$$

$$\frac{15\kappa}{2(x-1)}+\frac{5\kappa}{(x-1)^2}-\frac{5\kappa}{(x-1)^3}+\frac{15\kappa}{2(x-1)^4}+\frac{33\kappa}{2(x-1)^5}-\frac{33\kappa}{2}-\frac{5}{2(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2(x-1)^4}+\frac{49}{6(x-1)^5}-$$

$$\frac{49}{6}\Big)H(0,0;x)+\Big(d_1\alpha_0^4+d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{x-1}+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{16}{3}d_1\kappa\alpha_0^3-\frac{4d_1\kappa\alpha_0^3}{x-1}+\frac{4d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+$$

$$12d_1\alpha_0^2+12d_1\kappa\alpha_0^2+\frac{6d_1\kappa\alpha_0^2}{x-1}-\frac{4d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-16d_1\kappa\alpha_0-\frac{4d_1\kappa\alpha_0}{x-1}+$$

$$\frac{4d_1\kappa\alpha_0}{(x-1)^2}-\frac{4d_1\kappa\alpha_0}{(x-1)^3}+\frac{4d_1\kappa\alpha_0}{(x-1)^4}-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{d_1}{6}+\frac{25d_1\kappa}{6}+\frac{5d_1\kappa}{2(x-1)}-\frac{5d_1\kappa}{3(x-1)^2}+\frac{5d_1\kappa}{3(x-1)^3}-$$

$$\frac{5d_1\kappa}{2(x-1)^4}-\frac{25d_1\kappa}{6(x-1)^5}+\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-\frac{5d_1}{2(x-1)^4}-\frac{49d_1}{6(x-1)^5}\Big)H(0,1;\alpha_0)+H(1;x)\Big(\frac{\pi^2\kappa d_1}{3(x-1)^5}+$$

$$\frac{\pi^2 d_1}{3(x-1)^5}-\frac{\pi^2\kappa}{2(x-1)^5}+\frac{\pi^2\kappa}{2}+\Big(-\frac{2\kappa d_1}{x-1}+\frac{\kappa d_1}{(x-1)^2}-\frac{2\kappa d_1}{3(x-1)^3}+\frac{\kappa d_1}{2(x-1)^4}+\frac{25\kappa d_1}{6(x-1)^5}-\frac{2d_1}{x-1}+\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+$$

$$\frac{d_1}{2(x-1)^4}+\frac{49d_1}{6(x-1)^5}+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{33\kappa}{4}+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-$$

$$\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{49}{12}\Big)H(0;\alpha_0)+\Big(-\frac{4\kappa d_1}{(x-1)^5}-\frac{4d_1}{(x-1)^5}+\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0,0;\alpha_0)+\Big(-$$

$$\frac{4d_1^2}{(x-1)^5}+\frac{2\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1\Big)H(0,1;\alpha_0)-\frac{\pi^2}{6(x-1)^5}+\frac{\pi^2}{6}\Big)+\Big(-\frac{2\kappa d_1}{(x-1)^5}+2\kappa d_1-\frac{2d_1}{(x-1)^5}+2d_1+$$

$$\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(0,1;x)+\Big(\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{33\kappa}{4}+$$

$$\Big(\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)+\Big(\frac{2\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1\Big)H(1;\alpha_0)+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+$$

$$\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{49}{12}\Big)H(0,c_1(\alpha_0);x)+\Big(d_1\alpha_0^4+d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{x-1}+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{16}{3}d_1\kappa\alpha_0^3-$$

$$\frac{4d_1\kappa\alpha_0^3}{x-1}+\frac{4d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+12d_1\kappa\alpha_0^2+\frac{6d_1\kappa\alpha_0^2}{x-1}-\frac{4d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+$$

$$\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-16d_1\kappa\alpha_0-\frac{4d_1\kappa\alpha_0}{x-1}+\frac{4d_1\kappa\alpha_0}{(x-1)^2}-\frac{4d_1\kappa\alpha_0}{(x-1)^3}+\frac{4d_1\kappa\alpha_0}{(x-1)^4}-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+$$

$$\frac{25d_1}{3}+\frac{25d_1\kappa}{3}+\frac{d_1\kappa}{x-1}-\frac{4d_1\kappa}{3(x-1)^2}+\frac{2d_1\kappa}{(x-1)^3}-\frac{4d_1\kappa}{(x-1)^4}+\frac{d_1}{x-1}-\frac{4d_1}{3(x-1)^2}+\frac{2d_1}{(x-1)^3}-\frac{4d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{2\kappa d_1}{x-1}-$$

$$\frac{\kappa d_1}{(x-1)^2}+\frac{2\kappa d_1}{3(x-1)^3}-\frac{\kappa d_1}{2(x-1)^4}-\frac{25\kappa d_1}{6(x-1)^5}+\frac{2d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2(x-1)^4}-\frac{49d_1}{6(x-1)^5}-\frac{15\kappa}{4(x-1)}+\frac{5\kappa}{2(x-1)^2}-$$

$$\frac{5\kappa}{2(x-1)^3}+\frac{15\kappa}{4(x-1)^4}+\frac{33\kappa}{4(x-1)^5}-\frac{33\kappa}{4}-\frac{5}{4(x-1)}+\frac{5}{6(x-1)^2}-\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}+\frac{49}{12(x-1)^5}-\frac{49}{12}\Big)H(1,0;x)+$$

$$\Big(d_1^2\alpha_0^4+\frac{d_1^2\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}-\frac{4d_1^2\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2+\frac{6d_1^2\alpha_0^2}{x-1}-\frac{4d_1^2\alpha_0^2}{(x-1)^2}+\frac{2d_1^2\alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0-\frac{4d_1^2\alpha_0}{x-1}+\frac{4d_1^2\alpha_0}{(x-1)^2}-$$

$$\frac{4d_1^2\alpha_0}{(x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{d_1^2}{x-1}-\frac{4d_1^2}{3(x-1)^2}+\frac{2d_1^2}{(x-1)^3}-\frac{4d_1^2}{(x-1)^4}\Big)H(1,1;\alpha_0)+H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{8}+\frac{1}{8}d_1\kappa\alpha_0^4+$$

$$\frac{d_1\kappa\alpha_0^4}{8(x-1)}-\frac{7\kappa\alpha_0^4}{8(x-1)}-\frac{7\kappa\alpha_0^4}{8}+\frac{d_1\alpha_0^4}{8(x-1)}-\frac{5\alpha_0^4}{8(x-1)}-\frac{5\alpha_0^4}{8}-\frac{13d_1\alpha_0^3}{18}-\frac{13}{18}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{2(x-1)}+\frac{7\kappa\alpha_0^3}{2(x-1)}+\frac{2d_1\kappa\alpha_0^3}{9(x-1)^2}-$$

$$\frac{19\kappa\alpha_0^3}{12(x-1)^2}+\frac{61\kappa\alpha_0^3}{12}-\frac{d_1\alpha_0^3}{2(x-1)}+\frac{5\alpha_0^3}{2(x-1)}+\frac{2d_1\alpha_0^3}{9(x-1)^2}-\frac{35\alpha_0^3}{36(x-1)^2}+\frac{125\alpha_0^3}{36}+\frac{23d_1\alpha_0^2}{12}+\frac{23}{12}d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{4(x-1)}-\frac{41\kappa\alpha_0^2}{8(x-1)}-$$

$$\frac{2d_1\kappa\alpha_0^2}{3(x-1)^2}+\frac{39\kappa\alpha_0^2}{8(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{2(x-1)^3}-\frac{27\kappa\alpha_0^2}{8(x-1)^3}-\frac{107\kappa\alpha_0^2}{8}+\frac{3d_1\alpha_0^2}{4(x-1)}-\frac{89\alpha_0^2}{24(x-1)}-\frac{2d_1\alpha_0^2}{3(x-1)^2}+\frac{71\alpha_0^2}{24(x-1)^2}+\frac{d_1\alpha_0^2}{2(x-1)^3}-$$

$$\frac{43\alpha_0^2}{24(x-1)^3}-\frac{203\alpha_0^2}{24}-\frac{25d_1\alpha_0}{6}-\frac{25d_1\kappa\alpha_0}{6}-\frac{d_1\kappa\alpha_0}{2(x-1)}+\frac{5\kappa\alpha_0}{2(x-1)}+\frac{2d_1\kappa\alpha_0}{3(x-1)^2}-\frac{5\kappa\alpha_0}{(x-1)^2}-\frac{d_1\kappa\alpha_0}{(x-1)^3}+\frac{15\kappa\alpha_0}{2(x-1)^3}+\frac{2d_1\kappa\alpha_0}{(x-1)^4}-$$

$$\frac{45\kappa\alpha_0}{4(x-1)^4}+\frac{105\kappa\alpha_0}{4}-\frac{d_1\alpha_0}{2(x-1)}+\frac{13\alpha_0}{6(x-1)}+\frac{2d_1\alpha_0}{3(x-1)^2}-\frac{3\alpha_0}{(x-1)^2}-\frac{d_1\alpha_0}{(x-1)^3}+\frac{23\alpha_0}{6(x-1)^3}+\frac{2d_1\alpha_0}{(x-1)^4}-\frac{61\alpha_0}{12(x-1)^4}+\frac{169\alpha_0}{12}+$$

$$\frac{205d_1}{72}+\frac{205d_1\kappa}{72}+\frac{17d_1\kappa}{8(x-1)}-\frac{45\kappa}{4(x-1)}-\frac{13d_1\kappa}{18(x-1)^2}+\frac{35\kappa}{6(x-1)^2}+\frac{13d_1\kappa}{18(x-1)^3}-\frac{35\kappa}{6(x-1)^3}-\frac{17d_1\kappa}{8(x-1)^4}+\frac{45\kappa}{4(x-1)^4}-$$

$$\frac{205d_1\kappa}{72(x-1)^5}+\frac{205\kappa}{12(x-1)^5}-\frac{205\kappa}{12}+\Big(\frac{3\kappa\alpha_0^4}{2(x-1)}+\frac{3\kappa\alpha_0^4}{2}+\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}-\frac{6\kappa\alpha_0^3}{x-1}+\frac{2\kappa\alpha_0^3}{(x-1)^2}-8\kappa\alpha_0^3-\frac{2\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{3(x-1)^2}-$$

$$\frac{8\alpha_0^3}{3}+\frac{9\kappa\alpha_0^2}{x-1}-\frac{6\kappa\alpha_0^2}{(x-1)^2}+\frac{3\kappa\alpha_0^2}{(x-1)^3}+18\kappa\alpha_0^2+\frac{3\alpha_0^2}{x-1}-\frac{2\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2-\frac{6\kappa\alpha_0}{x-1}+\frac{6\kappa\alpha_0}{(x-1)^2}-\frac{6\kappa\alpha_0}{(x-1)^3}+\frac{6\kappa\alpha_0}{(x-1)^4}-$$

$$24\kappa\alpha_0-\frac{2\alpha_0}{x-1}+\frac{2\alpha_0}{(x-1)^2}-\frac{2\alpha_0}{(x-1)^3}+\frac{2\alpha_0}{(x-1)^4}-8\alpha_0+\frac{15\kappa}{2(x-1)}-\frac{5\kappa}{(x-1)^2}+\frac{5\kappa}{(x-1)^3}-\frac{15\kappa}{2(x-1)^4}-\frac{33\kappa}{2(x-1)^5}+\frac{25\kappa}{2}+$$

$$\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}-\frac{49}{6(x-1)^5}+\frac{25}{6}\Big)H(0;\alpha_0)+\Big(\frac{d_1\alpha_0^4}{2}+\frac{1}{2}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{2(x-1)}+\frac{d_1\alpha_0^4}{2(x-1)}-$$

$$\frac{8d_1\alpha_0^3}{3}-\frac{8}{3}d_1\kappa\alpha_0^3-\frac{2d_1\kappa\alpha_0^3}{x-1}+\frac{2d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{2d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\alpha_0^2+6d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+$$

$$\frac{3d_1\alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-8d_1\alpha_0-8d_1\kappa\alpha_0-\frac{2d_1\kappa\alpha_0}{x-1}+\frac{2d_1\kappa\alpha_0}{(x-1)^2}-\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{2d_1\kappa\alpha_0}{(x-1)^4}-\frac{2d_1\alpha_0}{x-1}+\frac{2d_1\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+$$

$$\frac{2d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{6}+\frac{25d_1\kappa}{6}+\frac{5d_1\kappa}{2(x-1)}-\frac{5d_1\kappa}{3(x-1)^2}+\frac{5d_1\kappa}{3(x-1)^3}-\frac{5d_1\kappa}{2(x-1)^4}-\frac{25d_1\kappa}{6(x-1)^5}+\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-$$

$$\frac{5d_1}{2(x-1)^4}-\frac{49d_1}{6(x-1)^5}\Big)H(1;\alpha_0)+\Big(\frac{12\kappa}{(x-1)^5}+\frac{4}{(x-1)^5}\Big)H(0,0;\alpha_0)+\Big(\frac{4\kappa d_1}{(x-1)^5}+\frac{4d_1}{(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(\frac{4\kappa d_1}{(x-1)^5}+$$

$$\frac{4d_1}{(x-1)^5}\Big)H(1,0;\alpha_0)+\frac{4d_1^2H(1,1;\alpha_0)}{(x-1)^5}+\frac{17d_1}{8(x-1)}-\frac{65}{12(x-1)}-\frac{13d_1}{18(x-1)^2}+\frac{55}{18(x-1)^2}+\frac{13d_1}{18(x-1)^3}-\frac{55}{18(x-1)^3}-$$

$$\frac{17d_1}{8(x-1)^4}+\frac{65}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^2}{6(x-1)^5}+\frac{449}{36(x-1)^5}-\frac{305}{36}\Big)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{4\kappa d_1}{(x-1)^5}+2\kappa d_1-\frac{4d_1}{(x-1)^5}+2d_1+$$

$$\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0;\alpha_0)H(1,1;x)+\Big(-\frac{2\kappa d_1}{x-1}+\frac{\kappa d_1}{(x-1)^2}-\frac{2\kappa d_1}{3(x-1)^3}+\frac{\kappa d_1}{2(x-1)^4}+\frac{25\kappa d_1}{6(x-1)^5}-\frac{2d_1}{x-1}+$$

$$\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{d_1}{2(x-1)^4}+\frac{49d_1}{6(x-1)^5}+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{33\kappa}{4}+\Big(-\frac{4\kappa d_1}{(x-1)^5}-$$

$$\frac{4d_1}{(x-1)^5}+\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{2\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1\Big)H(1;\alpha_0)+$$

$$\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{49}{12}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{3\kappa\alpha_0^4}{4(x-1)}+\frac{3\kappa\alpha_0^4}{4}+\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}-$$

$$\frac{3\kappa\alpha_0^3}{x-1}+\frac{\kappa\alpha_0^3}{(x-1)^2}-4\kappa\alpha_0^3-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{9\kappa\alpha_0^2}{2(x-1)}-\frac{3\kappa\alpha_0^2}{(x-1)^2}+\frac{3\kappa\alpha_0^2}{2(x-1)^3}+9\kappa\alpha_0^2+\frac{3\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{(x-1)^2}+$$

$$\frac{\alpha_0^2}{2(x-1)^3}+3\alpha_0^2-\frac{3\kappa\alpha_0}{x-1}+\frac{3\kappa\alpha_0}{(x-1)^2}-\frac{3\kappa\alpha_0}{(x-1)^3}+\frac{3\kappa\alpha_0}{(x-1)^4}-12\kappa\alpha_0-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}-$$

$$4\alpha_0+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{25\kappa}{4}+\Big(\frac{6\kappa}{(x-1)^5}+\frac{2}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{2\kappa d_1}{(x-1)^5}+$$

$$\frac{2d_1}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{25}{12}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+$$

$$\Big(\frac{12\kappa}{(x-1)^5}+12\kappa+\frac{4}{(x-1)^5}+4\Big)H(0,0,0;\alpha_0)+\Big(-\frac{12\kappa}{(x-1)^5}+12\kappa-\frac{4}{(x-1)^5}+4\Big)H(0,0,0;x)+\Big(\frac{4\kappa d_1}{(x-1)^5}+$$

$$4\kappa d_1+\frac{4d_1}{(x-1)^5}+4d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-2\Big)H(0,0,c_1(\alpha_0);x)+\Big(\frac{4\kappa d_1}{(x-1)^5}+4\kappa d_1+$$

$$\frac{4d_1}{(x-1)^5}+4d_1\Big)H(0,1,0;\alpha_0)+\Big(\frac{2\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{2d_1}{(x-1)^5}-2d_1-\frac{6\kappa}{(x-1)^5}+6\kappa-\frac{2}{(x-1)^5}+2\Big)H(0,1,0;x)+$$

$$\Big(\frac{4d_1^2}{(x-1)^5}+4d_1^2\Big)H(0,1,1;\alpha_0)+\Big(-\frac{2\kappa d_1}{(x-1)^5}+2\kappa d_1-\frac{2d_1}{(x-1)^5}+2d_1+\frac{6\kappa}{(x-1)^5}-6\kappa+\frac{2}{(x-1)^5}-$$

$$2\Big)H(0,1,c_1(\alpha_0);x)+\Big(\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4\kappa d_1}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-\frac{6\kappa}{(x-1)^5}+$$

$$6\kappa-\frac{2}{(x-1)^5}+2\Big)H(1,0,0;x)+\Big(-\frac{2\kappa d_1}{(x-1)^5}-\frac{2d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(1,0,c_1(\alpha_0);x)+$$

$$\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{4\kappa d_1}{(x-1)^5}-2\kappa d_1+\frac{4d_1}{(x-1)^5}-2d_1-\frac{3\kappa}{(x-1)^5}+3\kappa-\frac{1}{(x-1)^5}+1\Big)H(1,1,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{4\kappa d_1}{(x-1)^5}+$$

$$2\kappa d_1-\frac{4d_1}{(x-1)^5}+2d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{2\kappa d_1}{(x-1)^5}-\frac{2d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-3\kappa+$$

$$\frac{1}{(x-1)^5}-1\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3\kappa}{(x-1)^5}+\frac{1}{(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{35\pi^2\kappa}{24(x-1)(\kappa+1)}+$$

$$\frac{35\pi^2\kappa}{36(x-1)^2(\kappa+1)}-\frac{35\pi^2\kappa}{36(x-1)^3(\kappa+1)}+\frac{35\pi^2\kappa}{24(x-1)^4(\kappa+1)}+\frac{247\pi^2\kappa}{72(x-1)^5(\kappa+1)}-\frac{247\pi^2\kappa}{72(\kappa+1)}-\frac{5\pi^2}{24(x-1)(\kappa+1)}+\frac{5\pi^2}{36(x-1)^2(\kappa+1)}-$$

$$\frac{5\pi^2}{36(x-1)^3(\kappa+1)}+\frac{5\pi^2}{24(x-1)^4(\kappa+1)}+\frac{49\pi^2}{72(x-1)^5(\kappa+1)}-\frac{25\pi^2}{72(\kappa+1)}-\frac{8}{\kappa+1}-\frac{7\kappa\zeta_3}{(x-1)^5(\kappa+1)}+\frac{7\kappa\zeta_3}{\kappa+1}-\frac{\zeta_3}{(x-1)^5(\kappa+1)}+\frac{3\zeta_3}{\kappa+1}.$$

D.2 The $\mathcal{A}$ integral for $k=1$ and arbitrary κ

The ε expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;\kappa,1,0,g_A) &= x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;\kappa,1) \\
&= \frac{1}{\varepsilon}a_{-1}^{(\kappa,1)} + a_0^{(\kappa,1)} + \varepsilon a_1^{(\kappa,1)} + \varepsilon^2 a_2^{(\kappa,1)} + \mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{D.2}
$$

where

$$a_{-1}^{(\kappa,1)} = -\frac{1}{2(\kappa+1)},$$

$$
\begin{aligned}
a_0^{(\kappa,1)} = {}& \frac{\alpha_0^4}{8(x-1)} + \frac{\kappa\alpha_0^4}{8(\kappa+1)} + \frac{\alpha_0^4}{8(\kappa+1)} - \frac{\alpha_0^3}{2(x-1)} - \frac{2\kappa\,\alpha_0^3}{3(\kappa+1)} - \frac{2\alpha_0^3}{3(\kappa+1)} + \frac{\alpha_0^3}{6\,(x-1)^2} + \frac{3\alpha_0^2}{4(x-1)} + \frac{3\kappa\alpha_0^2}{2(\kappa+1)} + {} \\
& \frac{3\alpha_0^2}{2(\kappa+1)} - \frac{\alpha_0^2}{2\,(x-1)^2} + \frac{\alpha_0^2}{4(x-1)^3} - \frac{\alpha_0}{2(x-1)} - \frac{2\kappa\,\alpha_0}{\kappa+1} - \frac{2\alpha_0}{\kappa+1} + \frac{\alpha_0}{2\,(x-1)^2} - \frac{\alpha_0}{2(x-1)^3} + \frac{\alpha_0}{2\,(x-1)^4} + \Big(\frac{1}{2} + {} \\
& \frac{1}{2(x-1)^5}\Big)\, H(0;\alpha_0) + \left(\frac{1}{2} - \frac{1}{2(x-1)^5}\right) H(0;x) + \frac{H(c_1(\alpha_0);x)}{2(x-1)^5} - \frac{1}{\kappa+1},
\end{aligned}
$$

$$
\begin{aligned}
a_1^{(\kappa,1)} = {}& \\
& -\frac{d_1\alpha_0^4}{16(\kappa+1)} - \frac{d_1\kappa\alpha_0^4}{16(\kappa+1)} - \frac{d_1\kappa\alpha_0^4}{16(x-1)(\kappa+1)} + \frac{7\kappa\,\alpha_0^4}{16(x-1)(\kappa+1)} + \frac{7\kappa\alpha_0^4}{16(\kappa+1)} - \frac{d_1\alpha_0^4}{16(x-1)(\kappa+1)} + \frac{5\alpha_0^4}{16(x-1)(\kappa+1)} + \frac{5\alpha_0^4}{16(\kappa+1)} + {} \\
& \frac{13d_1\alpha_0^3}{36\,(\kappa+1)} + \frac{13d_1\kappa\alpha_0^3}{36(\kappa+1)} + \frac{d_1\,\kappa\alpha_0^3}{4(x-1)(\kappa+1)} - \frac{7\kappa\alpha_0^3}{4(x-1)\,(\kappa+1)} - \frac{d_1\kappa\alpha_0^3}{9(x-1)^2(\kappa+1)} + \frac{19\,\kappa\alpha_0^3}{24(x-1)^2(\kappa+1)} - \frac{61\kappa\alpha_0^3}{24\,(\kappa+1)} + \frac{d_1\alpha_0^3}{4(x-1)(\kappa+1)} - {} \\
& \frac{5\alpha_0^3}{4\,(x-1)(\kappa+1)} - \frac{d_1\alpha_0^3}{9(x-1)^2(\kappa+1)} + \frac{35\,\alpha_0^3}{72(x-1)^2(\kappa+1)} - \frac{125\alpha_0^3}{72(\kappa+1)} - \frac{23d_1\alpha_0^2}{24(\kappa+1)} - \frac{23d_1\kappa\,\alpha_0^2}{24(\kappa+1)} - \frac{3d_1\kappa\alpha_0^2}{8(x-1)(\kappa+1)} + \frac{41\kappa\alpha_0^2}{16(x-1)(\kappa+1)} + {} \\
& \frac{d_1\kappa\,\alpha_0^2}{3(x-1)^2(\kappa+1)} - \frac{39\kappa\alpha_0^2}{16(x-1)^2\,(\kappa+1)} - \frac{d_1\kappa\alpha_0^2}{4(x-1)^3(\kappa+1)} + \frac{27\,\kappa\alpha_0^2}{16(x-1)^3(\kappa+1)} + \frac{107\kappa\alpha_0^2}{16\,(\kappa+1)} - \frac{3d_1\alpha_0^2}{8(x-1)(\kappa+1)} + \frac{89\,\alpha_0^2}{48(x-1)(\kappa+1)} + {} \\
& \frac{d_1\alpha_0^2}{3(x-1)^2(\kappa+1)} - \frac{71\alpha_0^2}{48(x-1)^2(\kappa+1)} - \frac{d_1\alpha_0^2}{4(x-1)^3\,(\kappa+1)} + \frac{43\alpha_0^2}{48(x-1)^3(\kappa+1)} + \frac{203\,\alpha_0^2}{48(\kappa+1)} + \frac{25d_1\alpha_0}{12(\kappa+1)} + \frac{25d_1\,\kappa\alpha_0}{12(\kappa+1)} + {} \\
& \frac{d_1\kappa\alpha_0}{4(x-1)(\kappa+1)} - \frac{5\kappa\alpha_0}{4(x-1)(\kappa+1)} - \frac{d_1\kappa\,\alpha_0}{3(x-1)^2(\kappa+1)} + \frac{5\kappa\alpha_0}{2(x-1)^2(\kappa+1)} + \frac{d_1\kappa\alpha_0}{2(x-1)^3(\kappa+1)} - \frac{15\kappa\,\alpha_0}{4(x-1)^3(\kappa+1)} - \frac{d_1\kappa\alpha_0}{(x-1)^4(\kappa+1)} + {} \\
& \frac{45\kappa\alpha_0}{8(x-1)^4(\kappa+1)} - \frac{105\kappa\,\alpha_0}{8(\kappa+1)} + \frac{d_1\alpha_0}{4(x-1)(\kappa+1)} - \frac{13\,\alpha_0}{12(x-1)(\kappa+1)} - \frac{d_1\alpha_0}{3(x-1)^2(\kappa+1)} + \frac{3\alpha_0}{2(x-1)^2(\kappa+1)} + \frac{d_1\alpha_0}{2(x-1)^3\,(\kappa+1)} - {} \\
& \frac{23\alpha_0}{12(x-1)^3(\kappa+1)} - \frac{d_1\,\alpha_0}{(x-1)^4(\kappa+1)} + \frac{61\alpha_0}{24(x-1)^4(\kappa+1)} - \frac{169\alpha_0}{24(\kappa+1)} + \Big(-\frac{\kappa\alpha_0^4}{4\,(x-1)} - \frac{\kappa\alpha_0^4}{4} - \frac{\alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{4} + \frac{\kappa\alpha_0^3}{x-1} - \frac{\kappa\alpha_0^3}{3(x-1)^2} + {} \\
& \frac{4\,\kappa\alpha_0^3}{3} + \frac{\alpha_0^3}{x-1} - \frac{\alpha_0^3}{3(x-1)^2} + \frac{4\,\alpha_0^3}{3} - \frac{3\kappa\alpha_0^2}{2(x-1)} + \frac{\kappa\,\alpha_0^2}{(x-1)^2} - \frac{\kappa\alpha_0^2}{2(x-1)^3} - 3\kappa\,\alpha_0^2 - \frac{3\alpha_0^2}{2(x-1)} + \frac{\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{2\,(x-1)^3} - 3\alpha_0^2 + {} \\
& \frac{\kappa\alpha_0}{x-1} - \frac{\kappa\alpha_0}{(x-1)^2} + \frac{\kappa\alpha_0}{(x-1)^3} - \frac{\kappa\alpha_0}{(x-1)^4} + 4\kappa\,\alpha_0 + \frac{\alpha_0}{x-1} - \frac{\alpha_0}{(x-1)^2} + \frac{\alpha_0}{(x-1)^3} - \frac{\alpha_0}{}(x-1)^4 + 4\alpha_0 - \frac{5\kappa}{8(x-1)} + \frac{5\kappa}{12\,(x-1)^2} - {} \\
& \frac{5\kappa}{12(x-1)^3} + \frac{5\kappa}{8\,(x-1)^4} + \frac{25\kappa}{24(x-1)^5} - \frac{25\kappa}{24} - \frac{5}{8(x-1)} + \frac{5}{12(x-1)^2} - \frac{5}{12\,(x-1)^3} + \frac{5}{8(x-1)^4} + \frac{49}{24(x-1)^5} - \frac{1}{24}\Big)\, H(0;\alpha_0) + {} \\
& \Big(\frac{5\kappa}{8(x-1)} - \frac{5\kappa}{12(x-1)^2} + \frac{5\kappa}{12(x-1)^3} - \frac{5\kappa}{8(x-1)^4} - \frac{25\,\kappa}{24(x-1)^5} + \frac{25\kappa}{24} + \frac{5}{8\,(x-1)} - \frac{5}{12(x-1)^2} + \frac{5}{12(x-1)^3} - \frac{5}{8(x-1)^4} - {} \\
& \frac{49}{24(x-1)^5} + \frac{49}{24}\Big) H(0;x) + \Big(-\frac{d_1\,\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{4(x-1)} + \frac{4d_1\alpha_0^3}{3} + \frac{d_1\,\alpha_0^3}{x-1} - \frac{d_1\alpha_0^3}{3(x-1)^2} - 3d_1\alpha_0^2 - \frac{3d_1\,\alpha_0^2}{2(x-1)} + \frac{d_1\alpha_0^2}{(x-1)^2} - \frac{d_1\alpha_0^2}{2\,(x-1)^3} + {} \\
& 4d_1\alpha_0 + \frac{d_1\alpha_0}{x-1} - \frac{d_1\,\alpha_0}{(x-1)^2} + \frac{d_1\alpha_0}{(x-1)^3} - \frac{d_1\,\alpha_0}{(x-1)^4} - \frac{25d_1}{12} - \frac{d_1}{4(x-1)} + \frac{d_1}{3\,(x-1)^2} - \frac{d_1}{2(x-1)^3} + \frac{d_1}{(x-1)^4}\Big)\, H(1;\alpha_0) + \Big(\frac{d_1}{(x-1)^5} - {} \\
& \frac{\kappa}{2\,(x-1)^5} + \frac{\kappa}{2} - \frac{1}{2(x-1)^5} + \frac{1}{2}\Big)\, H(0;\alpha_0)H(1;x) + \Big(-\frac{\kappa\alpha_0^4}{8(x-1)} - \frac{\kappa\,\alpha_0^4}{8} - \frac{\alpha_0^4}{8(x-1)} - \frac{\alpha_0^4}{8} + \frac{\kappa\,\alpha_0^3}{2(x-1)} - \frac{\kappa\alpha_0^3}{6(x-1)^2} + \frac{2\kappa\,\alpha_0^3}{3} + {} \\
& \frac{\alpha_0^3}{2(x-1)} - \frac{\alpha_0^3}{6(x-1)^2} + \frac{2\,\alpha_0^3}{3} - \frac{3\kappa\alpha_0^2}{4(x-1)} + \frac{\kappa\alpha_0^2}{2\,(x-1)^2} - \frac{\kappa\alpha_0^2}{4(x-1)^3} - \frac{3\kappa\,\alpha_0^2}{2} - \frac{3\alpha_0^2}{4(x-1)} + \frac{\alpha_0^2}{2\,(x-1)^2} - \frac{\alpha_0^2}{4(x-1)^3} - \frac{3\alpha_0^2}{2} + \frac{\kappa\,\alpha_0}{2(x-1)} - {} \\
& \frac{\kappa\alpha_0}{2(x-1)^2} + \frac{\kappa\alpha_0}{2\,(x-1)^3} - \frac{\kappa\alpha_0}{2(x-1)^4} + 2\kappa\alpha_0 + \frac{\alpha_0}{2\,(x-1)} - \frac{\alpha_0}{2(x-1)^2} + \frac{\alpha_0}{2(x-1)^3} - \frac{\alpha_0}{2\,(x-1)^4} + 2\alpha_0 - \frac{5\kappa}{8(x-1)} + \frac{5\kappa}{12\,(x-1)^2} - {} \\
& \frac{5\kappa}{12(x-1)^3} + \frac{5\kappa}{8\,(x-1)^4} + \frac{25\kappa}{24(x-1)^5} - \frac{25\kappa}{24} + \left(-\frac{\kappa}{(x-1)^5} - \frac{1}{(x-1)^5}\right) H(0;\alpha_0) - \frac{d_1H(1;\alpha_0)}{(x-1)^5} - \frac{5}{8(x-1)} + \frac{5}{12\,(x-1)^2} - {} \\
& \frac{5}{12(x-1)^3} + \frac{5}{8(x-1)^4} + \frac{49}{24\,(x-1)^5} - \frac{25}{24}\Big) H(c_1(\alpha_0);x) + \left(-\frac{\kappa}{(x-1)^5} - \kappa - \frac{1}{(x-1)^5} - 1\right) H(0,0;\alpha_0) + \Big(\frac{\kappa}{(x-1)^5} - \kappa + {} \\
& \frac{1}{(x-1)^5} - 1\Big) H(0,0;x) + \left(-\frac{d_1}{(x-1)^5} - d_1\right) H(0,1;\alpha_0) + \left(-\frac{\kappa}{2(x-1)^5} + \frac{\kappa}{2} - \frac{1}{2(x-1)^5} + \frac{1}{2}\right) H(0,c_1(\alpha_0);x) + \Big(- {} \\
& \frac{d_1}{(x-1)^5} + \frac{\kappa}{2\,(x-1)^5} - \frac{\kappa}{2} + \frac{1}{2(x-1)^5} - \frac{1}{2}\Big)\, H(1,0;x) + \left(\frac{d_1}{(x-1)^5} - \frac{\kappa}{2\,(x-1)^5} + \frac{\kappa}{2} - \frac{1}{2(x-1)^5} + \frac{1}{2}\right) H(1,c_1(\alpha_0);x) + {} \\
& \left(-\frac{\kappa}{2(x-1)^5} - \frac{1}{2\,(x-1)^5}\right) H(c_1(\alpha_0),c_1(\alpha_0);x) + \frac{\pi^2\kappa}{4(x-1)^5\,(\kappa+1)} - \frac{\pi^2\kappa}{4(\kappa+1)} + \frac{\pi^2}{12\,(x-1)^5(\kappa+1)} - \frac{2}{\kappa+1},
\end{aligned}
$$

$$
\begin{aligned}
a_2^{(\kappa,1)} = {} & \frac{d_1^2\alpha_0^4}{32(\kappa+1)} - \frac{3d_1\alpha_0^4}{16(\kappa+1)} + \frac{d_1^2\kappa\alpha_0^4}{32(\kappa+1)} - \frac{5d_1\kappa\alpha_0^4}{16(\kappa+1)} + \frac{d_1^2\kappa\alpha_0^4}{32(x-1)(\kappa+1)} - \frac{5d_1\kappa\alpha_0^4}{16(x-1)(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^4}{48(x-1)(\kappa+1)} + \\
& \frac{35\kappa\alpha_0^4}{32(x-1)(\kappa+1)} + \frac{35\kappa\alpha_0^4}{32(\kappa+1)} + \frac{d_1^2\alpha_0^4}{32(x-1)(\kappa+1)} - \frac{3d_1\alpha_0^4}{16(x-1)(\kappa+1)} - \frac{\pi^2\alpha_0^4}{48(x-1)(\kappa+1)} + \frac{21\alpha_0^4}{32(x-1)(\kappa+1)} + \frac{21\alpha_0^4}{32(\kappa+1)} - \frac{\pi^2\alpha_0^4}{48} - \\
& \frac{43d_1^2\alpha_0^3}{216(\kappa+1)} + \frac{505d_1\alpha_0^3}{432(\kappa+1)} - \frac{43d_1^2\kappa\alpha_0^3}{216(\kappa+1)} + \frac{33d_1\kappa\alpha_0^3}{16(\kappa+1)} - \frac{d_1^2\kappa\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{5d_1\kappa\alpha_0^3}{4(x-1)(\kappa+1)} + \frac{\pi^2\kappa\alpha_0^3}{12(x-1)(\kappa+1)} - \frac{35\kappa\alpha_0^3}{8(x-1)(\kappa+1)} + \\
& \frac{2d_1^2\kappa\alpha_0^3}{27(x-1)^2(\kappa+1)} - \frac{13d_1\kappa\alpha_0^3}{16(x-1)^2(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^3}{36(x-1)^2(\kappa+1)} + \frac{1055\kappa\alpha_0^3}{432(x-1)^2(\kappa+1)} - \frac{2945\kappa\alpha_0^3}{432(\kappa+1)} - \frac{d_1^2\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{3d_1\alpha_0^3}{4(x-1)(\kappa+1)} + \\
& \frac{\pi^2\alpha_0^3}{12(x-1)(\kappa+1)} - \frac{21\alpha_0^3}{8(x-1)(\kappa+1)} + \frac{2d_1^2\alpha_0^3}{27(x-1)^2(\kappa+1)} - \frac{181d_1\alpha_0^3}{432(x-1)^2(\kappa+1)} - \frac{\pi^2\alpha_0^3}{36(x-1)^2(\kappa+1)} + \frac{473\alpha_0^3}{432(x-1)^2(\kappa+1)} - \\
& \frac{1607\alpha_0^3}{432(\kappa+1)} + \frac{\pi^2\alpha_0^3}{9} + \frac{95d_1^2\alpha_0^2}{144(\kappa+1)} - \frac{347d_1\alpha_0^2}{96(\kappa+1)} + \frac{95d_1^2\kappa\alpha_0^2}{144(\kappa+1)} - \frac{673d_1\kappa\alpha_0^2}{96(\kappa+1)} + \frac{3d_1^2\kappa\alpha_0^2}{16(x-1)(\kappa+1)} - \frac{167d_1\kappa\alpha_0^2}{96(x-1)(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^2}{8(x-1)(\kappa+1)} + \\
& \frac{1721\kappa\alpha_0^2}{288(x-1)(\kappa+1)} - \frac{2d_1^2\kappa\alpha_0^2}{9(x-1)^2(\kappa+1)} + \frac{247d_1\kappa\alpha_0^2}{96(x-1)^2(\kappa+1)} + \frac{\pi^2\kappa\alpha_0^2}{12(x-1)^2(\kappa+1)} - \frac{2279\kappa\alpha_0^2}{288(x-1)^2(\kappa+1)} + \frac{d_1^2\kappa\alpha_0^2}{4(x-1)^3(\kappa+1)} - \\
& \frac{259d_1\kappa\alpha_0^2}{96(x-1)^3(\kappa+1)} - \frac{\pi^2\kappa\alpha_0^2}{24(x-1)^3(\kappa+1)} + \frac{1987\kappa\alpha_0^2}{288(x-1)^3(\kappa+1)} + \frac{5987\kappa\alpha_0^2}{288(\kappa+1)} + \frac{3d_1^2\alpha_0^2}{16(x-1)(\kappa+1)} - \frac{311d_1\alpha_0^2}{288(x-1)(\kappa+1)} - \frac{\pi^2\alpha_0^2}{8(x-1)(\kappa+1)} + \\
& \frac{1103\alpha_0^2}{288(x-1)(\kappa+1)} - \frac{2d_1^2\alpha_0^2}{9(x-1)^2(\kappa+1)} + \frac{125d_1\alpha_0^2}{96(x-1)^2(\kappa+1)} + \frac{\pi^2\alpha_0^2}{12(x-1)^2(\kappa+1)} - \frac{977\alpha_0^2}{288(x-1)^2(\kappa+1)} + \frac{d_1^2\alpha_0^2}{4(x-1)^3(\kappa+1)} - \\
& \frac{355d_1\alpha_0^2}{288(x-1)^3(\kappa+1)} - \frac{\pi^2\alpha_0^2}{24(x-1)^3(\kappa+1)} + \frac{661\alpha_0^2}{288(x-1)^3(\kappa+1)} + \frac{2741\alpha_0^2}{288(\kappa+1)} - \frac{\pi^2\alpha_0^2}{4} - \frac{205d_1^2\alpha_0}{72(\kappa+1)} + \frac{575d_1\alpha_0}{48(\kappa+1)} - \frac{205d_1^2\kappa\alpha_0}{72(\kappa+1)} + \\
& \frac{1325d_1\kappa\alpha_0}{48(\kappa+1)} - \frac{d_1^2\kappa\alpha_0}{8(x-1)(\kappa+1)} - \frac{d_1\kappa\alpha_0}{3(x-1)(\kappa+1)} + \frac{\pi^2\kappa\alpha_0}{12(x-1)(\kappa+1)} + \frac{16\kappa\alpha_0}{9(x-1)(\kappa+1)} + \frac{2d_1^2\kappa\alpha_0}{9(x-1)^2(\kappa+1)} - \frac{65d_1\kappa\alpha_0}{24(x-1)^2(\kappa+1)} - \\
& \frac{\pi^2\kappa\alpha_0}{12(x-1)^2(\kappa+1)} + \frac{17\kappa\alpha_0}{2(x-1)^2(\kappa+1)} - \frac{d_1^2\kappa\alpha_0}{2(x-1)^3(\kappa+1)} + \frac{161d_1\kappa\alpha_0}{24(x-1)^3(\kappa+1)} + \frac{\pi^2\kappa\alpha_0}{12(x-1)^3(\kappa+1)} - \frac{169\kappa\alpha_0}{9(x-1)^3(\kappa+1)} + \\
& \frac{2d_1^2\kappa\alpha_0}{(x-1)^4(\kappa+1)} - \frac{889d_1\kappa\alpha_0}{48(x-1)^4(\kappa+1)} - \frac{\pi^2\kappa\alpha_0}{12(x-1)^4(\kappa+1)} + \frac{334\kappa\alpha_0}{9(x-1)^4(\kappa+1)} - \frac{1127\kappa\alpha_0}{18(\kappa+1)} - \frac{d_1^2\alpha_0}{8(x-1)(\kappa+1)} + \frac{2d_1\alpha_0}{9(x-1)(\kappa+1)} + \\
& \frac{\pi^2\alpha_0}{12(x-1)(\kappa+1)} - \frac{14\alpha_0}{9(x-1)(\kappa+1)} + \frac{2d_1^2\alpha_0}{9(x-1)^2(\kappa+1)} - \frac{97d_1\alpha_0}{72(x-1)^2(\kappa+1)} - \frac{\pi^2\alpha_0}{12(x-1)^2(\kappa+1)} + \frac{7\alpha_0}{2(x-1)^2(\kappa+1)} - \\
& \frac{d_1^2\alpha_0}{2(x-1)^3(\kappa+1)} + \frac{209d_1\alpha_0}{72(x-1)^3(\kappa+1)} + \frac{\pi^2\alpha_0}{12(x-1)^3(\kappa+1)} - \frac{49\alpha_0}{9(x-1)^3(\kappa+1)} + \frac{2d_1^2\alpha_0}{(x-1)^4(\kappa+1)} - \frac{1081d_1\alpha_0}{144(x-1)^4(\kappa+1)} - \\
& \frac{\pi^2\alpha_0}{12(x-1)^4(\kappa+1)} + \frac{79\alpha_0}{9(x-1)^4(\kappa+1)} - \frac{347\alpha_0}{18(\kappa+1)} + \frac{\pi^2\alpha_0}{3} + \Bigg(\frac{d_1\alpha_0^4}{8} + \frac{1}{8}d_1\kappa\alpha_0^4 + \frac{d_1\kappa\alpha_0^4}{8(x-1)} - \frac{7\kappa\alpha_0^4}{8(x-1)} - \frac{7\kappa\alpha_0^4}{8} + \frac{d_1\alpha_0^4}{8(x-1)} - \\
& \frac{5\alpha_0^4}{8(x-1)} - \frac{5\alpha_0^4}{8} - \frac{13d_1\alpha_0^3}{18} - \frac{13}{18}d_1\kappa\alpha_0^3 - \frac{d_1\kappa\alpha_0^3}{2(x-1)} + \frac{7\kappa\alpha_0^3}{2(x-1)} + \frac{2d_1\kappa\alpha_0^3}{9(x-1)^2} - \frac{19\kappa\alpha_0^3}{12(x-1)^2} + \frac{61\kappa\alpha_0^3}{12} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{5\alpha_0^3}{2(x-1)} + \\
& \frac{2d_1\alpha_0^3}{9(x-1)^2} - \frac{35\alpha_0^3}{36(x-1)^2} + \frac{125\alpha_0^3}{36} + \frac{23d_1\alpha_0^2}{12} + \frac{23}{12}d_1\kappa\alpha_0^2 + \frac{3d_1\kappa\alpha_0^2}{4(x-1)} - \frac{41\kappa\alpha_0^2}{8(x-1)} - \frac{2d_1\kappa\alpha_0^2}{3(x-1)^2} + \frac{39\kappa\alpha_0^2}{8(x-1)^2} + \frac{d_1\kappa\alpha_0^2}{2(x-1)^3} - \frac{27\kappa\alpha_0^2}{8(x-1)^3} - \\
& \frac{107\kappa\alpha_0^2}{8} + \frac{3d_1\alpha_0^2}{4(x-1)} - \frac{89\alpha_0^2}{24(x-1)} - \frac{2d_1\alpha_0^2}{3(x-1)^2} + \frac{71\alpha_0^2}{24(x-1)^2} + \frac{d_1\alpha_0^2}{2(x-1)^3} - \frac{43\alpha_0^2}{24(x-1)^3} - \frac{203\alpha_0^2}{24} - \frac{25d_1\alpha_0}{6} - \frac{25d_1\kappa\alpha_0}{6} - \frac{d_1\kappa\alpha_0}{2(x-1)} + \\
& \frac{5\kappa\alpha_0}{2(x-1)} + \frac{2d_1\kappa\alpha_0}{3(x-1)^2} - \frac{5\kappa\alpha_0}{(x-1)^2} - \frac{d_1\kappa\alpha_0}{(x-1)^3} + \frac{15\kappa\alpha_0}{2(x-1)^3} + \frac{2d_1\kappa\alpha_0}{(x-1)^4} - \frac{45\kappa\alpha_0}{4(x-1)^4} + \frac{105\kappa\alpha_0}{4} - \frac{d_1\alpha_0}{2(x-1)} + \frac{13\alpha_0}{6(x-1)} + \frac{2d_1\alpha_0}{3(x-1)^2} - \\
& \frac{3\alpha_0}{(x-1)^2} - \frac{d_1\alpha_0}{(x-1)^3} + \frac{23\alpha_0}{6(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{61\alpha_0}{12(x-1)^4} + \frac{169\alpha_0}{12} + \frac{205d_1}{144} + \frac{205d_1\kappa}{144} + \frac{17d_1\kappa}{16(x-1)} - \frac{45\kappa}{8(x-1)} - \frac{13d_1\kappa}{36(x-1)^2} + \\
& \frac{35\kappa}{12(x-1)^2} + \frac{13d_1\kappa}{36(x-1)^3} - \frac{35\kappa}{12(x-1)^3} - \frac{17d_1\kappa}{16(x-1)^4} + \frac{45\kappa}{8(x-1)^4} - \frac{205d_1\kappa}{144(x-1)^5} + \frac{205\kappa}{24(x-1)^5} - \frac{205\kappa}{24} + \frac{17d_1}{16(x-1)} - \frac{65}{24(x-1)} - \\
& \frac{13d_1}{36(x-1)^2} + \frac{55}{36(x-1)^2} + \frac{13d_1}{36(x-1)^3} - \frac{55}{36(x-1)^3} - \frac{17d_1}{16(x-1)^4} + \frac{65}{24(x-1)^4} - \frac{205d_1}{144(x-1)^5} - \frac{\pi^2}{12(x-1)^5} + \frac{449}{72(x-1)^5} - \frac{\pi^2}{12} - \\
& \frac{161}{72}\Bigg) H(0;\alpha_0) + \Bigg(-\frac{17\kappa d_1}{16(x-1)} + \frac{13\kappa d_1}{36(x-1)^2} - \frac{13\kappa d_1}{36(x-1)^3} + \frac{17\kappa d_1}{16(x-1)^4} + \frac{205\kappa d_1}{144(x-1)^5} - \frac{205\kappa d_1}{144} - \frac{17d_1}{16(x-1)} + \frac{13d_1}{36(x-1)^2} - \\
& \frac{13d_1}{36(x-1)^3} + \frac{17d_1}{16(x-1)^4} + \frac{205d_1}{144(x-1)^5} - \frac{205d_1}{144} + \frac{45\kappa}{8(x-1)} - \frac{35\kappa}{12(x-1)^2} + \frac{35\kappa}{12(x-1)^3} - \frac{45\kappa}{8(x-1)^4} - \frac{\pi^2\kappa}{2(x-1)^5} - \frac{205\kappa}{24(x-1)^5} + \\
& \frac{\pi^2\kappa}{2} + \frac{205\kappa}{24} + \frac{65}{24(x-1)} - \frac{55}{36(x-1)^2} + \frac{55}{36(x-1)^3} - \frac{65}{24(x-1)^4} - \frac{\pi^2}{12(x-1)^5} - \frac{449}{72(x-1)^5} + \frac{\pi^2}{12} + \frac{449}{72}\Bigg) H(0;x) + \\
& \Bigg(\frac{d_1^2\alpha_0^4}{8} - \frac{5d_1\alpha_0^4}{8} - \frac{1}{8}d_1\kappa\alpha_0^4 - \frac{d_1\kappa\alpha_0^4}{8(x-1)} + \frac{d_1^2\alpha_0^4}{8(x-1)} - \frac{5d_1\alpha_0^4}{8(x-1)} - \frac{13d_1^2\alpha_0^3}{18} + \frac{125d_1\alpha_0^3}{36} + \frac{29}{36}d_1\kappa\alpha_0^3 + \frac{d_1\kappa\alpha_0^3}{2(x-1)} - \frac{11d_1\kappa\alpha_0^3}{36(x-1)^2} - \\
& \frac{d_1^2\alpha_0^3}{2(x-1)} + \frac{5d_1\alpha_0^3}{2(x-1)} + \frac{2d_1^2\alpha_0^3}{9(x-1)^2} - \frac{35d_1\alpha_0^3}{36(x-1)^2} + \frac{23d_1^2\alpha_0^2}{12} - \frac{203d_1\alpha_0^2}{24} - \frac{59}{24}d_1\kappa\alpha_0^2 - \frac{17d_1\kappa\alpha_0^2}{24(x-1)} + \frac{23d_1\kappa\alpha_0^2}{24(x-1)^2} - \frac{19d_1\kappa\alpha_0^2}{24(x-1)^3} + \\
& \frac{3d_1^2\alpha_0^2}{4(x-1)} - \frac{89d_1\alpha_0^2}{24(x-1)} - \frac{2d_1^2\alpha_0^2}{3(x-1)^2} + \frac{71d_1\alpha_0^2}{24(x-1)^2} + \frac{d_1^2\alpha_0^2}{2(x-1)^3} - \frac{43d_1\alpha_0^2}{24(x-1)^3} - \frac{25d_1^2\alpha_0}{6} + \frac{169d_1\alpha_0}{12} + \frac{73d_1\kappa\alpha_0}{12} + \frac{d_1\kappa\alpha_0}{6(x-1)} - \\
& \frac{d_1\kappa\alpha_0}{(x-1)^2} + \frac{11d_1\kappa\alpha_0}{6(x-1)^3} - \frac{37d_1\kappa\alpha_0}{12(x-1)^4} - \frac{d_1^2\alpha_0}{2(x-1)} + \frac{13d_1\alpha_0}{6(x-1)} + \frac{2d_1^2\alpha_0}{3(x-1)^2} - \frac{3d_1\alpha_0}{(x-1)^2} - \frac{d_1^2\alpha_0}{(x-1)^3} + \frac{23d_1\alpha_0}{6(x-1)^3} + \frac{2d_1^2\alpha_0}{(x-1)^4} - \frac{61d_1\alpha_0}{12(x-1)^4} + \\
& \frac{205d_1^2}{72} - \frac{305d_1}{36} - \frac{155d_1\kappa}{36} + \frac{d_1\kappa}{6(x-1)} + \frac{25d_1\kappa}{72(x-1)^2} - \frac{25d_1\kappa}{24(x-1)^3} + \frac{37d_1\kappa}{12(x-1)^4} + \frac{d_1^2}{8(x-1)} - \frac{d_1}{3(x-1)} - \frac{2d_1^2}{9(x-1)^2} + \frac{73d_1}{72(x-1)^2} + \\
& \frac{d_1^2}{2(x-1)^3} - \frac{49d_1}{24(x-1)^3} - \frac{2d_1^2}{(x-1)^4} + \frac{61d_1}{12(x-1)^4}\Bigg) H(1;\alpha_0) + \Bigg(\frac{3\kappa\alpha_0^4}{2(x-1)} + \frac{3\kappa\alpha_0^4}{2} + \frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} - \frac{6\kappa\alpha_0^3}{x-1} + \frac{2\kappa\alpha_0^3}{(x-1)^2} - 8\kappa\alpha_0^3 - \\
& \frac{2\alpha_0^3}{x-1} + \frac{2\alpha_0^3}{3(x-1)^2} - \frac{8\alpha_0^3}{3} + \frac{9\kappa\alpha_0^2}{x-1} - \frac{6\kappa\alpha_0^2}{(x-1)^2} + \frac{3\kappa\alpha_0^2}{(x-1)^3} + 18\kappa\alpha_0^2 + \frac{3\alpha_0^2}{x-1} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} + 6\alpha_0^2 - \frac{6\kappa\alpha_0}{x-1} + \frac{6\kappa\alpha_0}{(x-1)^2} -
\end{aligned}
$$

$$\frac{6\kappa\alpha_0}{(x-1)^3}+\frac{6\kappa\alpha_0}{(x-1)^4}-24\kappa\alpha_0-\frac{2\alpha_0}{x-1}+\frac{2\alpha_0}{(x-1)^2}-\frac{2\alpha_0}{(x-1)^3}+\frac{2\alpha_0}{(x-1)^4}-8\alpha_0+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-$$
$$\frac{33\kappa}{4(x-1)^5}+\frac{17\kappa}{4}+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{1}{12}\Big)H(0,0;\alpha_0)+\Big(-\frac{15\kappa}{4(x-1)}+\frac{5\kappa}{2(x-1)^2}-$$
$$\frac{5\kappa}{2(x-1)^3}+\frac{15\kappa}{4(x-1)^4}+\frac{33\kappa}{4(x-1)^5}-\frac{33\kappa}{4}-\frac{5}{4(x-1)}+\frac{5}{6(x-1)^2}-\frac{5}{6(x-1)^3}+\frac{5}{4(x-1)^4}+\frac{49}{12(x-1)^5}-\frac{49}{12}\Big)H(0,0;x)+$$
$$\Big(\frac{d_1\alpha_0^4}{2}+\frac{1}{2}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{2(x-1)}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{8d_1\alpha_0^3}{3}-\frac{8}{3}d_1\kappa\alpha_0^3-\frac{2d_1\kappa\alpha_0^3}{x-1}+\frac{2d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{2d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\alpha_0^2+$$
$$6d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{3d_1\alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-8d_1\alpha_0-8d_1\kappa\alpha_0-\frac{2d_1\kappa\alpha_0}{x-1}+\frac{2d_1\kappa\alpha_0}{(x-1)^2}-$$
$$\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{2d_1\kappa\alpha_0}{(x-1)^4}-\frac{2d_1\alpha_0}{x-1}+\frac{2d_1\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{2d_1\alpha_0}{(x-1)^4}+\frac{d_1}{12}+\frac{25d_1\kappa}{12}+\frac{5d_1\kappa}{4(x-1)}-\frac{5d_1\kappa}{6(x-1)^2}+\frac{5d_1\kappa}{6(x-1)^3}-\frac{5d_1\kappa}{4(x-1)^4}-$$
$$\frac{25d_1\kappa}{12(x-1)^5}+\frac{5d_1}{4(x-1)}-\frac{5d_1}{6(x-1)^2}+\frac{5d_1}{6(x-1)^3}-\frac{5d_1}{4(x-1)^4}-\frac{49d_1}{12(x-1)^5}\Big)H(0,1;\alpha_0)+H(1;x)\Big(\frac{\pi^2\kappa d_1}{6(x-1)^5}+\frac{\pi^2 d_1}{6(x-1)^5}-$$
$$\frac{\pi^2\kappa}{4(x-1)^5}+\frac{\pi^2\kappa}{4}+\Big(-\frac{\kappa d_1}{x-1}+\frac{\kappa d_1}{2(x-1)^2}-\frac{\kappa d_1}{3(x-1)^3}+\frac{\kappa d_1}{4(x-1)^4}+\frac{25\kappa d_1}{12(x-1)^5}-\frac{d_1}{x-1}+\frac{d_1}{2(x-1)^2}-\frac{d_1}{3(x-1)^3}+\frac{d_1}{4(x-1)^4}+$$
$$\frac{49d_1}{12(x-1)^5}+\frac{15\kappa}{8(x-1)}-\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4(x-1)^3}-\frac{15\kappa}{8(x-1)^4}-\frac{33\kappa}{8(x-1)^5}+\frac{33\kappa}{8}+\frac{5}{8(x-1)}-\frac{5}{12(x-1)^2}+\frac{5}{12(x-1)^3}-\frac{5}{8(x-1)^4}-$$
$$\frac{49}{24(x-1)^5}+\frac{49}{24}\Big)H(0;\alpha_0)+\Big(-\frac{2\kappa d_1}{(x-1)^5}-\frac{2d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0,0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}+$$
$$\frac{\kappa d_1}{(x-1)^5}-\kappa d_1+\frac{d_1}{(x-1)^5}-d_1\Big)H(0,1;\alpha_0)-\frac{\pi^2}{12(x-1)^5}+\frac{\pi^2}{12}\Big)+\Big(-\frac{\kappa d_1}{(x-1)^5}+\kappa d_1-\frac{d_1}{(x-1)^5}+d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+$$
$$\frac{1}{(x-1)^5}-1\Big)H(0;\alpha_0)H(0,1;x)+\Big(\frac{15\kappa}{8(x-1)}-\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4(x-1)^3}-\frac{15\kappa}{8(x-1)^4}-\frac{33\kappa}{8(x-1)^5}+\frac{33\kappa}{8}+\Big(\frac{3\kappa}{(x-1)^5}-3\kappa+$$
$$\frac{1}{(x-1)^5}-1\Big)H(0;\alpha_0)+\Big(\frac{\kappa d_1}{(x-1)^5}-\kappa d_1+\frac{d_1}{(x-1)^5}-d_1\Big)H(1;\alpha_0)+\frac{5}{8(x-1)}-\frac{5}{12(x-1)^2}+\frac{5}{12(x-1)^3}-\frac{5}{8(x-1)^4}-$$
$$\frac{49}{24(x-1)^5}+\frac{49}{24}\Big)H(0,c_1(\alpha_0);x)+\Big(\frac{d_1\alpha_0^4}{2}+\frac{1}{2}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{2(x-1)}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{8d_1\alpha_0^3}{3}-\frac{8}{3}d_1\kappa\alpha_0^3-\frac{2d_1\kappa\alpha_0^3}{x-1}+$$
$$\frac{2d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{2d_1\alpha_0^3}{x-1}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\alpha_0^2+6d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{3d_1\alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-$$
$$8d_1\alpha_0-8d_1\kappa\alpha_0-\frac{2d_1\kappa\alpha_0}{x-1}+\frac{2d_1\kappa\alpha_0}{(x-1)^2}-\frac{2d_1\kappa\alpha_0}{(x-1)^3}+\frac{2d_1\kappa\alpha_0}{(x-1)^4}-\frac{2d_1\alpha_0}{x-1}+\frac{2d_1\alpha_0}{(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{2d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{6}+\frac{25d_1\kappa}{6}+$$
$$\frac{d_1\kappa}{2(x-1)}-\frac{2d_1\kappa}{3(x-1)^2}+\frac{d_1\kappa}{(x-1)^3}-\frac{2d_1\kappa}{(x-1)^4}+\frac{d_1}{2(x-1)}-\frac{2d_1}{3(x-1)^2}+\frac{d_1}{(x-1)^3}-\frac{2d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{\kappa d_1}{x-1}-\frac{\kappa d_1}{2(x-1)^2}+$$
$$\frac{\kappa d_1}{3(x-1)^3}-\frac{\kappa d_1}{4(x-1)^4}-\frac{25\kappa d_1}{12(x-1)^5}+\frac{d_1}{x-1}-\frac{d_1}{2(x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{d_1}{4(x-1)^4}-\frac{49d_1}{12(x-1)^5}-\frac{15\kappa}{8(x-1)}+\frac{5\kappa}{4(x-1)^2}-$$
$$\frac{5\kappa}{4(x-1)^3}+\frac{15\kappa}{8(x-1)^4}+\frac{33\kappa}{8(x-1)^5}-\frac{33\kappa}{8}-\frac{5}{8(x-1)}+\frac{5}{12(x-1)^2}-\frac{5}{12(x-1)^3}+\frac{5}{8(x-1)^4}+\frac{49}{24(x-1)^5}-\frac{49}{24}\Big)H(1,0;x)+$$
$$\Big(\frac{d_1^2\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{2(x-1)}-\frac{8d_1^2\alpha_0^3}{3}-\frac{2d_1^2\alpha_0^3}{x-1}+\frac{2d_1^2\alpha_0^3}{3(x-1)^2}+6d_1^2\alpha_0^2+\frac{3d_1^2\alpha_0^2}{x-1}-\frac{2d_1^2\alpha_0^2}{(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-8d_1^2\alpha_0-\frac{2d_1^2\alpha_0}{x-1}+\frac{2d_1^2\alpha_0}{(x-1)^2}-$$
$$\frac{2d_1^2\alpha_0}{(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{6}+\frac{d_1^2}{2(x-1)}-\frac{2d_1^2}{3(x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{2d_1^2}{(x-1)^4}\Big)H(1,1;\alpha_0)+H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{16}+$$
$$\frac{1}{16}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{16(x-1)}-\frac{7\kappa\alpha_0^4}{16(x-1)}-\frac{7\kappa\alpha_0^4}{16}+\frac{d_1\alpha_0^4}{16(x-1)}-\frac{5\alpha_0^4}{16(x-1)}-\frac{5\alpha_0^4}{16}-\frac{13d_1\alpha_0^3}{36}-\frac{13}{36}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{4(x-1)}+\frac{7\kappa\alpha_0^3}{4(x-1)}+$$
$$\frac{d_1\kappa\alpha_0^3}{9(x-1)^2}-\frac{19\kappa\alpha_0^3}{24(x-1)^2}+\frac{61\kappa\alpha_0^3}{24}-\frac{d_1\alpha_0^3}{4(x-1)}+\frac{5\alpha_0^3}{4(x-1)}+\frac{d_1\alpha_0^3}{9(x-1)^2}-\frac{35\alpha_0^3}{72(x-1)^2}+\frac{125\alpha_0^3}{72}+\frac{23d_1\alpha_0^2}{24}+\frac{23}{24}d_1\kappa\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{8(x-1)}-$$
$$\frac{41\kappa\alpha_0^2}{16(x-1)}-\frac{d_1\kappa\alpha_0^2}{3(x-1)^2}+\frac{39\kappa\alpha_0^2}{16(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{4(x-1)^3}-\frac{27\kappa\alpha_0^2}{16(x-1)^3}-\frac{107\kappa\alpha_0^2}{16}+\frac{3d_1\alpha_0^2}{8(x-1)}-\frac{89\alpha_0^2}{48(x-1)}-\frac{d_1\alpha_0^2}{3(x-1)^2}+\frac{71\alpha_0^2}{48(x-1)^2}+$$
$$\frac{d_1\alpha_0^2}{4(x-1)^3}-\frac{43\alpha_0^2}{48(x-1)^3}-\frac{203\alpha_0^2}{48}-\frac{25d_1\alpha_0}{12}-\frac{25d_1\kappa\alpha_0}{12}-\frac{d_1\kappa\alpha_0}{4(x-1)}+\frac{5\kappa\alpha_0}{4(x-1)}+\frac{d_1\kappa\alpha_0}{3(x-1)^2}-\frac{5\kappa\alpha_0}{2(x-1)^2}-\frac{d_1\kappa\alpha_0}{2(x-1)^3}+$$
$$\frac{15\kappa\alpha_0}{4(x-1)^3}+\frac{d_1\kappa\alpha_0}{(x-1)^4}-\frac{45\kappa\alpha_0}{8(x-1)^4}+\frac{105\kappa\alpha_0}{8}-\frac{d_1\alpha_0}{4(x-1)}+\frac{13\alpha_0}{12(x-1)}+\frac{d_1\alpha_0}{3(x-1)^2}-\frac{3\alpha_0}{2(x-1)^2}-\frac{d_1\alpha_0}{2(x-1)^3}+\frac{23\alpha_0}{12(x-1)^3}+\frac{d_1\alpha_0}{(x-1)^4}-$$
$$\frac{61\alpha_0}{24(x-1)^4}+\frac{169\alpha_0}{24}+\frac{205d_1}{144}+\frac{205d_1\kappa}{144}+\frac{17d_1\kappa}{16(x-1)}-\frac{45\kappa}{8(x-1)}-\frac{13d_1\kappa}{36(x-1)^2}+\frac{35\kappa}{12(x-1)^2}+\frac{13d_1\kappa}{36(x-1)^3}-\frac{35\kappa}{12(x-1)^3}-$$
$$\frac{17d_1\kappa}{16(x-1)^4}+\frac{45\kappa}{8(x-1)^4}-\frac{205d_1\kappa}{144(x-1)^5}+\frac{205\kappa}{24(x-1)^5}-\frac{205\kappa}{24}+\Big(\frac{3\kappa\alpha_0^4}{4(x-1)}+\frac{3\kappa\alpha_0^4}{4}+\frac{\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{4}-\frac{3\kappa\alpha_0^3}{x-1}+\frac{\kappa\alpha_0^3}{(x-1)^2}-$$
$$4\kappa\alpha_0^3-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{9\kappa\alpha_0^2}{2(x-1)}-\frac{3\kappa\alpha_0^2}{(x-1)^2}+\frac{3\kappa\alpha_0^2}{2(x-1)^3}+9\kappa\alpha_0^2+\frac{3\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2(x-1)^3}+3\alpha_0^2-$$
$$\frac{3\kappa\alpha_0}{x-1}+\frac{3\kappa\alpha_0}{(x-1)^2}-\frac{3\kappa\alpha_0}{(x-1)^3}+\frac{3\kappa\alpha_0}{(x-1)^4}-12\kappa\alpha_0-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{}(x-1)^4-4\alpha_0+\frac{15\kappa}{4(x-1)}-\frac{5\kappa}{2(x-1)^2}+$$
$$\frac{5\kappa}{2(x-1)^3}-\frac{15\kappa}{4(x-1)^4}-\frac{33\kappa}{4(x-1)^5}+\frac{25\kappa}{4}+\frac{5}{4(x-1)}-\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{5}{4(x-1)^4}-\frac{49}{12(x-1)^5}+\frac{25}{12}\Big)H(0;\alpha_0)+$$
$$\Big(\frac{d_1\alpha_0^4}{4}+\frac{1}{4}d_1\kappa\alpha_0^4+\frac{d_1\kappa\alpha_0^4}{4(x-1)}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{4d_1\alpha_0^3}{3}-\frac{4}{3}d_1\kappa\alpha_0^3-\frac{d_1\kappa\alpha_0^3}{x-1}+\frac{d_1\kappa\alpha_0^3}{3(x-1)^2}-\frac{d_1\alpha_0^3}{x-1}+\frac{d_1\alpha_0^3}{3(x-1)^2}+3d_1\alpha_0^2+$$

$$
3d_1\kappa\,\alpha_0^2+\frac{3d_1\kappa\alpha_0^2}{2(x-1)}-\frac{d_1\kappa\,\alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{2(x-1)^3}+\frac{3d_1\,\alpha_0^2}{2(x-1)}-\frac{d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{2\,(x-1)^3}-4d_1\alpha_0-4d_1\kappa\alpha_0-\frac{d_1\kappa\,\alpha_0}{x-1}+\frac{d_1\kappa\alpha_0}{(x-1)^2}-
$$
$$
\frac{d_1\kappa\,\alpha_0}{(x-1)^3}+\frac{d_1\kappa\alpha_0}{(x-1)^4}-\frac{d_1\,\alpha_0}{x-1}+\frac{d_1\alpha_0}{(x-1)^2}-\frac{d_1\alpha_0}{(x-1)^3}+\frac{d_1\,\alpha_0}{(x-1)^4}+\frac{25d_1}{12}+\frac{25d_1\kappa}{12}+\frac{5d_1\,\kappa}{4(x-1)}-\frac{5d_1\kappa}{6(x-1)^2}+\frac{5d_1\kappa}{6(x-1)^3}-\frac{5d_1\kappa}{4(x-1)^4}-
$$
$$
\frac{25d_1\kappa}{12\,(x-1)^5}+\frac{5d_1}{4(x-1)}-\frac{5d_1}{6(x-1)^2}+\frac{5d_1}{6\,(x-1)^3}-\frac{5d_1}{4(x-1)^4}-\frac{49d_1}{12(x-1)^5}\Big)\,H(1;\alpha_0)+\Big(\frac{6\kappa}{(x-1)^5}+\frac{2}{(x-1)^5}\Big)H(0,0;\,\alpha_0)+
$$
$$
\Big(\frac{2\kappa d_1}{(x-1)^5}+\frac{2d_1}{(x-1)^5}\Big)\,H(0,1;\alpha_0)+\Big(\frac{2\kappa d_1}{(x-1)^5}+\frac{2\,d_1}{(x-1)^5}\Big)H(1,0;\alpha_0)+\frac{2d_1^2\,H(1,1;\alpha_0)}{(x-1)^5}+\frac{17d_1}{16(x-1)}-\frac{65}{24\,(x-1)}-
$$
$$
\frac{13d_1}{36(x-1)^2}+\frac{55}{36(x-1)^2}+\frac{13\,d_1}{36(x-1)^3}-\frac{55}{36(x-1)^3}-\frac{17d_1}{16\,(x-1)^4}+\frac{65}{24(x-1)^4}-\frac{205d_1}{144(x-1)^5}-\frac{\pi^2}{12(x-1)^5}+\frac{449}{72\,(x-1)^5}-
$$
$$
\frac{305}{72}\Big)+\Big(\frac{2d_1^2}{(x-1)^5}-\frac{2\,\kappa d_1}{(x-1)^5}+\kappa d_1-\frac{2d_1}{(x-1)^5}+d_1+\frac{3\,\kappa}{2(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2\,(x-1)^5}-\frac{1}{2}\Big)H(0;\alpha_0)H(1,1;x)+\Big(-
$$
$$
\frac{\kappa\,d_1}{x-1}+\frac{\kappa d_1}{2(x-1)^2}-\frac{\kappa d_1}{3\,(x-1)^3}+\frac{\kappa d_1}{4(x-1)^4}+\frac{25\kappa d_1}{12\,(x-1)^5}-\frac{d_1}{x-1}+\frac{d_1}{2(x-1)^2}-\frac{d_1}{3(x-1)^3}+\frac{d_1}{4(x-1)^4}+\frac{49d_1}{12(x-1)^5}+\frac{15\kappa}{8\,(x-1)}-
$$
$$
\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4\,(x-1)^3}-\frac{15\kappa}{8(x-1)^4}-\frac{33\kappa}{8\,(x-1)^5}+\frac{33\kappa}{8}+\Big(-\frac{2\kappa\,d_1}{(x-1)^5}-\frac{2d_1}{(x-1)^5}+\frac{3\kappa}{(x-1)^5}-3\,\kappa+\frac{1}{(x-1)^5}-1\Big)H(0;\alpha_0)+
$$
$$
\Big(-\frac{2\,d_1^2}{(x-1)^5}+\frac{\kappa d_1}{(x-1)^5}-\kappa\,d_1+\frac{d_1}{(x-1)^5}-d_1\Big)H(1;\alpha_0)+\frac{5}{8\,(x-1)}-\frac{5}{12(x-1)^2}+\frac{5}{12(x-1)^3}-\frac{5}{8(x-1)^4}-\frac{49}{24(x-1)^5}+
$$
$$
\frac{49}{24}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{3\,\kappa\alpha_0^4}{8(x-1)}+\frac{3\kappa\alpha_0^4}{8}+\frac{\alpha_0^4}{8\,(x-1)}+\frac{\alpha_0^4}{8}-\frac{3\kappa\alpha_0^3}{2(x-1)}+\frac{\kappa\,\alpha_0^3}{2(x-1)^2}-2\kappa\alpha_0^3-\frac{\alpha_0^3}{2\,(x-1)}+\frac{\alpha_0^3}{6(x-1)^2}-\frac{2\alpha_0^3}{3}+
$$
$$
\frac{9\kappa\,\alpha_0^2}{4(x-1)}-\frac{3\kappa\alpha_0^2}{2(x-1)^2}+\frac{3\kappa\,\alpha_0^2}{4(x-1)^3}+\frac{9\kappa\alpha_0^2}{2}+\frac{3\alpha_0^2}{4\,(x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{4(x-1)^3}+\frac{3\,\alpha_0^2}{2}-\frac{3\kappa\alpha_0}{2(x-1)}+\frac{3\kappa\alpha_0}{2\,(x-1)^2}-\frac{3\kappa\alpha_0}{2(x-1)^3}+
$$
$$
\frac{3\kappa\alpha_0}{2\,(x-1)^4}-6\kappa\alpha_0-\frac{\alpha_0}{2(x-1)}+\frac{\alpha_0}{2\,(x-1)^2}-\frac{\alpha_0}{2(x-1)^3}+\frac{\alpha_0}{2(x-1)^4}-2\alpha_0+\frac{15\,\kappa}{8(x-1)}-\frac{5\kappa}{4(x-1)^2}+\frac{5\kappa}{4\,(x-1)^3}-\frac{15\kappa}{8(x-1)^4}-
$$
$$
\frac{33\kappa}{8\,(x-1)^5}+\frac{25\kappa}{8}+\Big(\frac{3\kappa}{(x-1)^5}+\frac{1}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{\kappa\,d_1}{(x-1)^5}+\frac{d_1}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{5}{8\,(x-1)}-\frac{5}{12(x-1)^2}+
$$
$$
\frac{5}{12(x-1)^3}-\frac{5}{8(x-1)^4}-\frac{49}{24(x-1)^5}+\frac{25}{24}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{6\kappa}{(x-1)^5}+6\kappa+\frac{2}{(x-1)^5}+2\Big)H(0,0,0;\,\alpha_0)+
$$
$$
\Big(-\frac{6\kappa}{(x-1)^5}+6\kappa-\frac{2}{(x-1)^5}+2\Big)H(0,0,0;x)+\Big(\frac{2\kappa\,d_1}{(x-1)^5}+2\kappa d_1+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(0,0,1;\,\alpha_0)+\Big(\frac{3\kappa}{(x-1)^5}-
$$
$$
3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0,0,c_1(\alpha_0);x)+\Big(\frac{2\kappa\,d_1}{(x-1)^5}+2\kappa d_1+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(0,1,0;\,\alpha_0)+\Big(\frac{\kappa d_1}{(x-1)^5}-
$$
$$
\kappa\,d_1+\frac{d_1}{(x-1)^5}-d_1-\frac{3\kappa}{(x-1)^5}+3\kappa-\frac{1}{(x-1)^5}+1\Big)H(0,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}+2\,d_1^2\Big)H(0,1,1;\alpha_0)+\Big(-
$$
$$
\frac{\kappa d_1}{(x-1)^5}+\kappa\,d_1-\frac{d_1}{(x-1)^5}+d_1+\frac{3\kappa}{(x-1)^5}-3\kappa+\frac{1}{(x-1)^5}-1\Big)H(0,1,c_1(\alpha_0);x)+\Big(\frac{3\kappa}{2\,(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2(x-1)^5}-
$$
$$
\frac{1}{2}\Big)\,H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2\kappa d_1}{(x-1)^5}+\frac{2\,d_1}{(x-1)^5}-\frac{3\kappa}{(x-1)^5}+3\kappa-\frac{1}{(x-1)^5}+1\Big)H(1,0,0;x)+\Big(-\frac{\kappa\,d_1}{(x-1)^5}-
$$
$$
\frac{d_1}{(x-1)^5}+\frac{3\kappa}{2(x-1)^5}-\frac{3\,\kappa}{2}+\frac{1}{2(x-1)^5}-\frac{1}{2}\Big)\,H(1,0,c_1(\alpha_0);x)+\Big(-\frac{2d_1^2}{(x-1)^5}+\frac{2\kappa\,d_1}{(x-1)^5}-\kappa d_1+\frac{2d_1}{(x-1)^5}-d_1-
$$
$$
\frac{3\kappa}{2(x-1)^5}+\frac{3\kappa}{2}-\frac{1}{2(x-1)^5}+\frac{1}{2}\Big)\,H(1,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}-\frac{2\kappa\,d_1}{(x-1)^5}+\kappa d_1-\frac{2d_1}{(x-1)^5}+d_1+\frac{3\kappa}{2(x-1)^5}-\frac{3\kappa}{2}+\frac{1}{2(x-1)^5}-
$$
$$
\frac{1}{2}\Big)\,H(1,1,c_1(\alpha_0);x)+\Big(-\frac{\kappa\,d_1}{(x-1)^5}-\frac{d_1}{(x-1)^5}+\frac{3\kappa}{2(x-1)^5}-\frac{3\,\kappa}{2}+\frac{1}{2(x-1)^5}-\frac{1}{2}\Big)\,H(1,c_1(\alpha_0),c_1(\alpha_0);x)+
$$
$$
\Big(\frac{3\kappa}{2(x-1)^5}+\frac{1}{2\,(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{35\pi^2\kappa}{48(x-1)(\kappa+1)}+\frac{35\pi^2\kappa}{72(x-1)^2(\kappa+1)}-\frac{35\pi^2\kappa}{72(x-1)^3(\kappa+1)}+
$$
$$
\frac{35\pi^2\,\kappa}{48(x-1)^4(\kappa+1)}+\frac{247\pi^2\kappa}{144\,(x-1)^5(\kappa+1)}-\frac{247\pi^2\kappa}{144(\kappa+1)}-\frac{5\pi^2}{48(x-1)(\kappa+1)}+\frac{5\pi^2}{72(x-1)^2\,(\kappa+1)}-\frac{5\pi^2}{72(x-1)^3(\kappa+1)}+
$$
$$
\frac{5\pi^2}{48(x-1)^4(\kappa+1)}+\frac{49\pi^2}{144(x-1)^5(\kappa+1)}-\frac{25\pi^2}{144(\kappa+1)}-\frac{4}{\kappa+1}-\frac{7\,\kappa\zeta_3}{2(x-1)^5(\kappa+1)}+\frac{7\kappa\zeta_3}{2\,(\kappa+1)}-\frac{\zeta_3}{2(x-1)^5(\kappa+1)}+\frac{3\zeta_3}{2\,(\kappa+1)}.
$$

D.3 The $\mathcal{A}$ integral for $k=2$ and arbitrary κ

The ε expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;\kappa,2,0,g_A) &= x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;\kappa,2)\\
&= \frac{1}{\varepsilon}a_{-1}^{(\kappa,2)}+a_0^{(\kappa,2)}+\varepsilon a_1^{(\kappa,2)}+\varepsilon a_2^{(\kappa,2)}+\mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{D.3}
$$

where

$$
a_{-1}^{(\kappa,2)}=-\frac{1}{3(\kappa+1)},
$$

$$a_0^{(\kappa,2)} = -\frac{\alpha_0^6}{3(x\alpha_0-2\alpha_0-x)} + \frac{\alpha_0^5}{3(x-2)} + \frac{5\,\alpha_0^5}{3(x\alpha_0-2\alpha_0-x)} - \frac{5\alpha_0^4}{4(x-2)} + \frac{\alpha_0^4}{12\,(x-1)} - \frac{10\alpha_0^4}{3(x\alpha_0-2\alpha_0-x)} +$$

$$\frac{\kappa\alpha_0^4}{12\,(\kappa+1)} + \frac{\alpha_0^4}{12(\kappa+1)} + \frac{5\alpha_0^4}{6\,(x-2)^2} + \frac{5\alpha_0^3}{3(x-2)} - \frac{\alpha_0^3}{3(x-1)} + \frac{10\,\alpha_0^3}{3(x\alpha_0-2\alpha_0-x)} - \frac{4\kappa\alpha_0^3}{9(\kappa+1)} - \frac{4\alpha_0^3}{9(\kappa+1)} - \frac{20\alpha_0^3}{9\,(x-2)^2} +$$

$$\frac{\alpha_0^3}{9(x-1)^2} + \frac{20\alpha_0^3}{9(x-2)^3} - \frac{5\,\alpha_0^2}{6(x-2)} + \frac{\alpha_0^2}{2(x-1)} - \frac{5\alpha_0^2}{3(x\alpha_0-2\,\alpha_0-x)} + \frac{\kappa\alpha_0^2}{\kappa+1} + \frac{\alpha_0^2}{\kappa+1} + \frac{5\alpha_0^2}{3(x-2)^2} - \frac{\alpha_0^2}{3(x-1)^2} - \frac{10\,\alpha_0^2}{3(x-2)^3} +$$

$$\frac{\alpha_0^2}{6(x-1)^3} + \frac{20\alpha_0^2}{3(x-2)^4} - \frac{\alpha_0}{3(x-1)} + \frac{\alpha_0}{3(x\alpha_0-2\alpha_0-x)} - \frac{4\kappa\,\alpha_0}{3(\kappa+1)} - \frac{4\alpha_0}{3(\kappa+1)} + \frac{\alpha_0}{3\,(x-1)^2} - \frac{\alpha_0}{3(x-1)^3} + \frac{\alpha_0}{3(x-1)^4} +$$

$$\frac{80\alpha_0}{3\,(x-2)^5} + \left(\frac{1}{3(x-1)^5} + \frac{1}{3} + \frac{80}{3\,(x-2)^5} + \frac{160}{3(x-2)^6}\right)H(0;\alpha_0) + \left(-\frac{1}{3\,(x-1)^5} + \frac{1}{3} - \frac{80}{3(x-2)^5} -\right.$$

$$\left.\frac{160}{3(x-2)^6}\right)\,H(0;x) + \frac{H(c_1(\alpha_0);x)}{3(x-1)^5} + \left(\frac{80}{3\,(x-2)^5} + \frac{160}{3(x-2)^6}\right)H(c_2(\alpha_0);x) - \frac{13}{18\,(\kappa+1)} + \frac{80\ln 2}{3(x-2)^5} + \frac{160\ln 2}{3\,(x-2)^6},$$

$$a_1^{(\kappa,2)} = \frac{1}{\alpha_0(x-2)-x}\Bigg\{ - \frac{1}{24}d_1x\alpha_0^5 - \frac{d_1\alpha_0^5}{12(x-2)} + \frac{d_1\,\alpha_0^5}{24(x-1)} + \frac{2x\alpha_0^5}{9(\kappa+1)} + \frac{11x\kappa\,\alpha_0^5}{36(\kappa+1)} + \frac{25\kappa\alpha_0^5}{36(x-2)(\kappa+1)} -$$

$$\frac{11\kappa\alpha_0^5}{36(x-1)(\kappa+1)} + \frac{\kappa\alpha_0^5}{24\,(\kappa+1)} + \frac{19\alpha_0^5}{36(x-2)(\kappa+1)} - \frac{2\alpha_0^5}{9\,(x-1)(\kappa+1)} + \frac{\alpha_0^5}{24(\kappa+1)} - \frac{7d_1\,\alpha_0^4}{108} + \frac{61}{216}d_1x\alpha_0^4 + \frac{11d_1\alpha_0^4}{54(x-2)} - \frac{43d_1\alpha_0^4}{216(x-1)} -$$

$$\frac{157x\alpha_0^4}{108(\kappa+1)} - \frac{56x\kappa\alpha_0^4}{27(\kappa+1)} - \frac{113\kappa\,\alpha_0^4}{54(x-2)(\kappa+1)} + \frac{149\kappa\alpha_0^4}{108(x-1)\,(\kappa+1)} + \frac{149\kappa\alpha_0^4}{54(x-2)^2(\kappa+1)} - \frac{59\kappa\alpha_0^4}{108(x-1)^2(\kappa+1)} + \frac{41\kappa\,\alpha_0^4}{216(\kappa+1)} -$$

$$\frac{91\alpha_0^4}{54(x-2)(\kappa+1)} + \frac{53\alpha_0^4}{54(x-1)(\kappa+1)} + \frac{103\alpha_0^4}{54\,(x-2)^2(\kappa+1)} - \frac{37\alpha_0^4}{108(x-1)^2(\kappa+1)} + \frac{\alpha_0^4}{216(\kappa+1)} - \frac{23d_1\alpha_0^4}{54\,(x-2)^2} + \frac{2d_1\alpha_0^4}{27(x-1)^2} + \frac{4d_1\,\alpha_0^3}{9} -$$

$$\frac{95}{108}d_1x\alpha_0^3 + \frac{d_1\alpha_0^3}{54\,(x-2)} + \frac{41d_1\alpha_0^3}{108(x-1)} + \frac{911x\alpha_0^3}{216(\kappa+1)} + \frac{1381x\kappa\alpha_0^3}{216(\kappa+1)} + \frac{25\kappa\,\alpha_0^3}{27(x-2)(\kappa+1)} - \frac{239\kappa\alpha_0^3}{108(x-1)\,(\kappa+1)} - \frac{104\kappa\alpha_0^3}{27(x-2)^2(\kappa+1)} +$$

$$\frac{467\kappa\alpha_0^3}{216(x-1)^2(\kappa+1)} + \frac{388\,\kappa\alpha_0^3}{27(x-2)^3(\kappa+1)} - \frac{83\kappa\alpha_0^3}{72\,(x-1)^3(\kappa+1)} - \frac{83\kappa\alpha_0^3}{36(\kappa+1)} + \frac{35\,\alpha_0^3}{27(x-2)(\kappa+1)} - \frac{175\alpha_0^3}{108(x-1)(\kappa+1)} - \frac{88\alpha_0^3}{27(x-2)^2(\kappa+1)} +$$

$$\frac{277\alpha_0^3}{216(x-1)^2\,(\kappa+1)} + \frac{236\alpha_0^3}{27(x-2)^3(\kappa+1)} - \frac{5\,\alpha_0^3}{8(x-1)^3(\kappa+1)} - \frac{35\alpha_0^3}{36(\kappa+1)} + \frac{8\,d_1\alpha_0^3}{27(x-2)^2} - \frac{17d_1\alpha_0^3}{54(x-1)^2} - \frac{76d_1\,\alpha_0^3}{27(x-2)^3} + \frac{d_1\alpha_0^3}{6(x-1)^3} -$$

$$\frac{35d_1\,\alpha_0^2}{18} + \frac{73}{36}d_1x\alpha_0^2 - \frac{4d_1\alpha_0^2}{9\,(x-2)} - \frac{13d_1\alpha_0^2}{36(x-1)} - \frac{569x\alpha_0^2}{72(\kappa+1)} - \frac{979x\kappa\alpha_0^2}{72(\kappa+1)} + \frac{16\kappa\,\alpha_0^2}{3(x-2)(\kappa+1)} - \frac{2\kappa\alpha_0^2}{3(x-1)(\kappa+1)} - \frac{10\kappa\alpha_0^2}{(x-2)^2(\kappa+1)} -$$

$$\frac{67\kappa\,\alpha_0^2}{24(x-1)^2(\kappa+1)} + \frac{80\kappa\alpha_0^2}{3(x-2)^3\,(\kappa+1)} + \frac{119\kappa\alpha_0^2}{24(x-1)^3(\kappa+1)} + \frac{1256\kappa\alpha_0^2}{9(x-2)^4(\kappa+1)} - \frac{137\,\kappa\alpha_0^2}{36(x-1)^4(\kappa+1)} + \frac{32\kappa\alpha_0^2}{3\,(\kappa+1)} + \frac{16\alpha_0^2}{9(x-2)(\kappa+1)} +$$

$$\frac{\alpha_0^2}{2\,(x-1)(\kappa+1)} - \frac{10\alpha_0^2}{3(x-2)^2(\kappa+1)} - \frac{119\,\alpha_0^2}{72(x-1)^2(\kappa+1)} + \frac{80\alpha_0^2}{9(x-2)^3(\kappa+1)} + \frac{19\alpha_0^2}{8(x-1)^3(\kappa+1)} + \frac{632\alpha_0^2}{9\,(x-2)^4(\kappa+1)} - \frac{7\alpha_0^2}{4(x-1)^4(\kappa+1)} +$$

$$\frac{85\,\alpha_0^2}{18(\kappa+1)} + \frac{5d_1\alpha_0^2}{3(x-2)^2} + \frac{d_1\,\alpha_0^2}{2(x-1)^2} - \frac{80d_1\alpha_0^2}{9(x-2)^3} - \frac{5d_1\alpha_0^2}{6\,(x-1)^3} - \frac{104d_1\alpha_0^2}{3(x-2)^4} + \frac{2d_1\alpha_0^2}{3\,(x-1)^4} - \frac{d_1\alpha_0}{3(\kappa+1)} - \frac{25d_1x\alpha_0}{18(\kappa+1)} + \frac{371x\alpha_0}{108(\kappa+1)} -$$

$$\frac{d_1\kappa\alpha_0}{3\,(\kappa+1)} - \frac{25d_1x\kappa\alpha_0}{18(\kappa+1)} - \frac{\pi^2\,x\kappa\alpha_0}{6(\kappa+1)} + \frac{323x\kappa\alpha_0}{36(\kappa+1)} + \frac{2d_1\kappa\alpha_0}{9(x-2)(\kappa+1)} + \frac{4\kappa\,\alpha_0}{3(x-2)(\kappa+1)} + \frac{d_1\kappa\alpha_0}{18(x-1)(\kappa+1)} - \frac{11\kappa\alpha_0}{4(x-1)(\kappa+1)} -$$

$$\frac{10d_1\kappa\,\alpha_0}{9(x-2)^2(\kappa+1)} - \frac{d_1\kappa\alpha_0}{9(x-1)^2(\kappa+1)} + \frac{17\kappa\alpha_0}{12(x-1)^2(\kappa+1)} + \frac{80d_1\,\kappa\alpha_0}{9(x-2)^3(\kappa+1)} - \frac{40\kappa\alpha_0}{3(x-2)^3(\kappa+1)} + \frac{d_1\kappa\alpha_0}{3(x-1)^3(\kappa+1)} - \frac{3\,\kappa\alpha_0}{2(x-1)^3(\kappa+1)} +$$

$$\frac{208d_1\kappa\alpha_0}{3\,(x-2)^4(\kappa+1)} + \frac{20\pi^2\kappa\alpha_0}{3(x-2)^4(\kappa+1)} - \frac{2512\kappa\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{2d_1\,\kappa\alpha_0}{3(x-1)^4(\kappa+1)} + \frac{\pi^2\kappa\alpha_0}{6\,(x-1)^4(\kappa+1)} - \frac{137\kappa\alpha_0}{36(x-1)^4(\kappa+1)} +$$

$$\frac{256d_1\kappa\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{40\pi^2\kappa\alpha_0}{3(x-2)^5(\kappa+1)} - \frac{3584\kappa\alpha_0}{9\,(x-2)^5(\kappa+1)} - \frac{\pi^2\kappa\alpha_0}{6(x-1)^5(\kappa+1)} + \frac{\pi^2\kappa\alpha_0}{3(\kappa+1)} + \frac{109\kappa\,\alpha_0}{36(\kappa+1)} + \frac{2d_1\alpha_0}{9(x-2)(\kappa+1)} + \frac{4\,\alpha_0}{9(x-2)(\kappa+1)} +$$

$$\frac{d_1\alpha_0}{18(x-1)(\kappa+1)} - \frac{11\alpha_0}{12(x-1)(\kappa+1)} - \frac{10d_1\alpha_0}{9(x-2)^2\,(\kappa+1)} - \frac{d_1\alpha_0}{9(x-1)^2(\kappa+1)} + \frac{17\alpha_0}{36\,(x-1)^2(\kappa+1)} + \frac{80d_1\alpha_0}{9(x-2)^3(\kappa+1)} -$$

$$\frac{40\alpha_0}{9(x-2)^3(\kappa+1)} + \frac{d_1\alpha_0}{3(x-1)^3\,(\kappa+1)} - \frac{\alpha_0}{2(x-1)^3(\kappa+1)} + \frac{208d_1\alpha_0}{3\,(x-2)^4(\kappa+1)} + \frac{20\pi^2\alpha_0}{9(x-2)^4(\kappa+1)} - \frac{1264\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{2d_1\alpha_0}{3\,(x-1)^4(\kappa+1)} +$$

$$\frac{\pi^2\alpha_0}{18(x-1)^4(\kappa+1)} - \frac{7\alpha_0}{4(x-1)^4(\kappa+1)} + \frac{256d_1\alpha_0}{3(x-2)^5\,(\kappa+1)} + \frac{40\pi^2\alpha_0}{9(x-2)^5(\kappa+1)} - \frac{2048\,\alpha_0}{9(x-2)^5(\kappa+1)} - \frac{\pi^2\alpha_0}{18(x-1)^5(\kappa+1)} + \frac{545\alpha_0}{108(\kappa+1)} +$$

$$\frac{80\kappa\ln^2 2\,\alpha_0}{(x-2)^4(\kappa+1)} + \frac{160\kappa\ln^2 2\,\alpha_0}{(x-2)^5(\kappa+1)} + \frac{80\ln^2 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{160\,\ln^2 2\,\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{32d_1\kappa\ln 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{352\kappa\ln 2\,\alpha_0}{9(x-2)^4\,(\kappa+1)} + \frac{64d_1\kappa\ln 2\,\alpha_0}{3(x-2)^5(\kappa+1)} +$$

$$\frac{704\kappa\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{32\,d_1\ln 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{544\ln 2\,\alpha_0}{9\,(x-2)^4(\kappa+1)} + \frac{64d_1\ln 2\,\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{1088\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \Bigg(-\frac{x\,\alpha_0^5}{6} - \frac{1}{6}x\kappa\alpha_0^5 - \frac{\kappa\alpha_0^5}{3\,(x-2)} +$$

$$\frac{\kappa\alpha_0^5}{6(x-1)} - \frac{\alpha_0^5}{3\,(x-2)} + \frac{\alpha_0^5}{6(x-1)} + \frac{19x\alpha_0^4}{18} + \frac{19}{18}x\,\kappa\alpha_0^4 + \frac{10\kappa\alpha_0^4}{9(x-2)} - \frac{13\kappa\,\alpha_0^4}{18(x-1)} - \frac{10\kappa\alpha_0^4}{9(x-2)^2} + \frac{2\kappa\,\alpha_0^4}{9(x-1)^2} - \frac{\kappa\alpha_0^4}{9} + \frac{10\alpha_0^4}{9\,(x-2)} -$$

$$\frac{13\alpha_0^4}{18(x-1)} - \frac{10\alpha_0^4}{9(x-2)^2} + \frac{2\,\alpha_0^4}{9(x-1)^2} - \frac{\alpha_0^4}{9} - \frac{26x\alpha_0^3}{9} - \frac{26}{9}x\,\kappa\alpha_0^3 - \frac{10\kappa\alpha_0^3}{9(x-2)} + \frac{11\kappa\,\alpha_0^3}{9(x-1)} + \frac{20\kappa\alpha_0^3}{9(x-2)^2} - \frac{7\kappa\,\alpha_0^3}{9(x-1)^2} - \frac{40\kappa\alpha_0^3}{9(x-2)^3} +$$

$$\frac{\kappa\,\alpha_0^3}{3(x-1)^3} + \frac{2\kappa\alpha_0^3}{3} - \frac{10\alpha_0^3}{9(x-2)} + \frac{11\alpha_0^3}{9(x-1)} + \frac{20\alpha_0^3}{9(x-2)^2} - \frac{7\alpha_0^3}{9\,(x-1)^2} - \frac{40\alpha_0^3}{9(x-2)^3} + \frac{\alpha_0^3}{3(x-1)^3} + \frac{2\,\alpha_0^3}{3} + \frac{14x\alpha_0^2}{3} + \frac{14}{3}x\kappa\,\alpha_0^2 - \frac{\kappa\alpha_0^2}{x-1} +$$

$$\frac{\kappa\,\alpha_0^2}{(x-1)^2} - \frac{\kappa\alpha_0^2}{(x-1)^3} - \frac{80\kappa\,\alpha_0^2}{3(x-2)^4} + \frac{2\kappa\alpha_0^2}{3(x-1)^4} - 2\kappa\,\alpha_0^2 - \frac{\alpha_0^2}{x-1} + \frac{\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} - \frac{80\alpha_0^2}{3(x-2)^4} + \frac{2\alpha_0^2}{3(x-1)^4} - 2\alpha_0^2 - \frac{95x\,\alpha_0}{36} -$$

$$\frac{121x\kappa\alpha_0}{36} - \frac{40\kappa\alpha_0}{9(x-2)} + \frac{65\kappa\alpha_0}{12(x-1)} + \frac{40\kappa\alpha_0}{9\,(x-2)^2} - \frac{25\kappa\alpha_0}{18(x-1)^2} + \frac{35\kappa\alpha_0}{36\,(x-1)^3} + \frac{96\kappa\alpha_0}{(x-2)^4} + \frac{31\kappa\alpha_0}{36\,(x-1)^4} + \frac{256\kappa\alpha_0}{3(x-2)^5} - \frac{25\kappa\alpha_0}{36\,(x-1)^5} -$$

$$\frac{4\kappa\alpha_0}{9} - \frac{40\alpha_0}{9(x-2)} + \frac{65\,\alpha_0}{12(x-1)} + \frac{40\alpha_0}{9(x-2)^2} - \frac{25\alpha_0}{18\,(x-1)^2} + \frac{35\alpha_0}{36(x-1)^3} + \frac{32d_1\alpha_0}{3\,(x-2)^4} + \frac{1504\alpha_0}{9(x-2)^4} + \frac{19\alpha_0}{12\,(x-1)^4} + \frac{64d_1\alpha_0}{3(x-2)^5} +$$

$$\frac{2048\alpha_0}{9\,(x-2)^5} - \frac{17\alpha_0}{12(x-1)^5} - \frac{17\,\alpha_0}{9} - \frac{x}{36} + \frac{25x\kappa}{36} - \frac{32\kappa}{9\,(x-2)} + \frac{43\kappa}{12(x-1)} + \frac{40\kappa}{9\,(x-2)^2} - \frac{4\kappa}{9(x-1)^2} - \frac{80\kappa}{9\,(x-2)^3} - \frac{\kappa}{36(x-1)^3} -$$

$$\frac{128\kappa}{3(x-2)^4}-\frac{43\kappa}{36(x-1)^4}-\frac{64\kappa}{(x-2)^5}-\frac{25\kappa}{36(x-1)^5}+\frac{128\kappa}{3(x-2)^6}+\frac{\kappa}{2}-\frac{32}{9(x-2)}+\frac{43}{12(x-1)}+\frac{40}{9(x-2)^2}-\frac{4}{9(x-1)^2}-\frac{80}{9(x-2)^3}-$$

$$\frac{1}{36(x-1)^3}-\frac{32d_1}{3(x-2)^4}-\frac{1024}{9(x-2)^4}-\frac{23}{12(x-1)^4}-\frac{128d_1}{3(x-2)^5}-\frac{3136}{9(x-2)^5}-\frac{17}{12(x-1)^5}-\frac{128d_1}{3(x-2)^6}-\frac{2176}{9(x-2)^6}+\frac{1}{2}\Big)H(0;\alpha_0)+$$

$$\Big(-\frac16 d_1x\alpha_0^5-\frac{d_1\alpha_0^5}{3(x-2)}+\frac{d_1\alpha_0^5}{6(x-1)}-\frac{d_1\alpha_0^4}{9}+\frac{19}{18}d_1x\alpha_0^4+\frac{10d_1\alpha_0^4}{9(x-2)}-\frac{13d_1\alpha_0^4}{18(x-1)}-\frac{10d_1\alpha_0^4}{9(x-2)^2}+\frac{2d_1\alpha_0^4}{9(x-1)^2}+\frac{2d_1\alpha_0^3}{3}-$$

$$\frac{26}{9}d_1x\alpha_0^3-\frac{10d_1\alpha_0^3}{9(x-2)}+\frac{11d_1\alpha_0^3}{9(x-1)}+\frac{20d_1\alpha_0^3}{9(x-2)^2}-\frac{7d_1\alpha_0^3}{9(x-1)^2}-\frac{40d_1\alpha_0^3}{9(x-2)^3}+\frac{d_1\alpha_0^3}{3(x-1)^3}-2d_1\alpha_0^2+\frac{14}{3}d_1x\alpha_0^2-\frac{d_1\alpha_0^2}{x-1}+\frac{d_1\alpha_0^2}{(x-1)^2}-$$

$$\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{80d_1\alpha_0^2}{3(x-2)^4}+\frac{2d_1\alpha_0^2}{3(x-1)^4}+\frac{10d_1\alpha_0}{9}-\frac{73d_1x\alpha_0}{18}+\frac{5d_1\alpha_0}{9(x-2)}+\frac{7d_1\alpha_0}{18(x-1)}-\frac{20d_1\alpha_0}{9(x-2)^2}-\frac{5d_1\alpha_0}{9(x-1)^2}+\frac{40d_1\alpha_0}{3(x-2)^3}+\frac{d_1\alpha_0}{(x-1)^3}+$$

$$\frac{320d_1\alpha_0}{3(x-2)^4}+\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{d_1}{3}+\frac{25d_1x}{18}-\frac{2d_1}{9(x-2)}-\frac{d_1}{18(x-1)}+\frac{10d_1}{9(x-2)^2}+\frac{d_1}{9(x-1)^2}-\frac{80d_1}{9(x-2)^3}-\frac{d_1}{3(x-1)^3}-\frac{80d_1}{(x-2)^4}-$$

$$\frac{2d_1}{3(x-1)^4}-\frac{320d_1}{3(x-2)^5}\Big)H(1;\alpha_0)+\Big(\frac{x\alpha_0}{3}+\frac{x\kappa\alpha_0}{3}+\frac{80\kappa\alpha_0}{3(x-2)^4}-\frac{\kappa\alpha_0}{3(x-1)^4}+\frac{160\kappa\alpha_0}{3(x-2)^5}+\frac{\kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\alpha_0}{3}+\frac{80\alpha_0}{3(x-2)^4}+$$

$$\frac{2d_1\alpha_0}{3(x-1)^4}-\frac{\alpha_0}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{2d_1\alpha_0}{3(x-1)^5}+\frac{\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3}-\frac{x}{3}-\frac{x\kappa}{3}-\frac{80\kappa}{3(x-2)^4}+\frac{\kappa}{3(x-1)^4}-\frac{320\kappa}{3(x-2)^5}+\frac{\kappa}{3(x-1)^5}-$$

$$\frac{320\kappa}{3(x-2)^6}-\frac{80}{3(x-2)^4}-\frac{2d_1}{3(x-1)^4}+\frac{1}{3(x-1)^4}-\frac{320}{3(x-2)^5}-\frac{2d_1}{3(x-1)^5}+\frac{1}{3(x-1)^5}-\frac{320}{3(x-2)^6}\Big)H(0;\alpha_0)H(1;x)+\Big(-$$

$$\frac{x\alpha_0^5}{12}-\frac{1}{12}x\kappa\alpha_0^5-\frac{\kappa\alpha_0^5}{6(x-2)}+\frac{\kappa\alpha_0^5}{12(x-1)}-\frac{\alpha_0^5}{6(x-2)}+\frac{\alpha_0^5}{12(x-1)}+\frac{19x\alpha_0^4}{36}+\frac{19}{36}x\kappa\alpha_0^4+\frac{5\kappa\alpha_0^4}{9(x-2)}-\frac{13\kappa\alpha_0^4}{36(x-1)}-\frac{5\kappa\alpha_0^4}{9(x-2)^2}+$$

$$\frac{\kappa\alpha_0^4}{9(x-1)^2}-\frac{\kappa\alpha_0^4}{18}+\frac{5\alpha_0^4}{9(x-2)}-\frac{13\alpha_0^4}{36(x-1)}-\frac{5\alpha_0^4}{9(x-2)^2}+\frac{\alpha_0^4}{9(x-1)^2}-\frac{\alpha_0^4}{18}-\frac{13x\alpha_0^3}{9}-\frac{13}{9}x\kappa\alpha_0^3-\frac{5\kappa\alpha_0^3}{9(x-2)}+\frac{11\kappa\alpha_0^3}{18(x-1)}+$$

$$\frac{10\kappa\alpha_0^3}{9(x-2)^2}-\frac{7\kappa\alpha_0^3}{18(x-1)^2}-\frac{20\kappa\alpha_0^3}{9(x-2)^3}+\frac{\kappa\alpha_0^3}{6(x-1)^3}+\frac{\kappa\alpha_0^3}{3}-\frac{5\alpha_0^3}{9(x-2)}+\frac{11\alpha_0^3}{18(x-1)}+\frac{10\alpha_0^3}{9(x-2)^2}-\frac{7\alpha_0^3}{18(x-1)^2}-\frac{20\alpha_0^3}{9(x-2)^3}+$$

$$\frac{\alpha_0^3}{6(x-1)^3}+\frac{\alpha_0^3}{3}+\frac{7x\alpha_0^2}{3}+\frac73x\kappa\alpha_0^2-\frac{\kappa\alpha_0^2}{2(x-1)}+\frac{\kappa\alpha_0^2}{2(x-1)^2}-\frac{\kappa\alpha_0^2}{2(x-1)^3}-\frac{40\kappa\alpha_0^2}{3(x-2)^4}+\frac{\kappa\alpha_0^2}{3(x-1)^4}-\kappa\alpha_0^2-\frac{\alpha_0^2}{2(x-1)}+\frac{\alpha_0^2}{2(x-1)^2}-$$

$$\frac{\alpha_0^2}{2(x-1)^3}-\frac{40\alpha_0^2}{3(x-2)^4}+\frac{\alpha_0^2}{3(x-1)^4}-\alpha_0^2-\frac{73x\alpha_0}{36}-\frac{73x\kappa\alpha_0}{36}-\frac{40\kappa\alpha_0}{9(x-2)}+\frac{65\kappa\alpha_0}{12(x-1)}+\frac{40\kappa\alpha_0}{9(x-2)^2}-\frac{25\kappa\alpha_0}{18(x-1)^2}+\frac{35\kappa\alpha_0}{36(x-1)^3}+$$

$$\frac{80\kappa\alpha_0}{(x-2)^4}+\frac{19\kappa\alpha_0}{36(x-1)^4}+\frac{160\kappa\alpha_0}{3(x-2)^5}-\frac{25\kappa\alpha_0}{36(x-1)^5}+\frac{2\kappa\alpha_0}{9}-\frac{40\alpha_0}{9(x-2)}+\frac{65\alpha_0}{12(x-1)}+\frac{40\alpha_0}{9(x-2)^2}-\frac{25\alpha_0}{18(x-1)^2}+\frac{35\alpha_0}{36(x-1)^3}+$$

$$\frac{80\alpha_0}{(x-2)^4}+\frac{5\alpha_0}{4(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{17\alpha_0}{12(x-1)^5}+\frac{2\alpha_0}{9}+\frac{25x}{36}+\frac{25x\kappa}{36}-\frac{32\kappa}{9(x-2)}+\frac{43\kappa}{12(x-1)}+\frac{40\kappa}{9(x-2)^2}-\frac{4\kappa}{9(x-1)^2}-\frac{80\kappa}{9(x-2)^3}-$$

$$\frac{\kappa}{36(x-1)^3}-\frac{160\kappa}{3(x-2)^4}-\frac{43\kappa}{36(x-1)^4}-\frac{320\kappa}{3(x-2)^5}-\frac{25\kappa}{36(x-1)^5}+\frac{\kappa}{2}+\Big(-\frac{2\kappa\alpha_0}{3(x-1)^4}+\frac{2\kappa\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^5}+$$

$$\frac{2\kappa}{3(x-1)^4}+\frac{2\kappa}{3(x-1)^5}+\frac{2}{3(x-1)^4}+\frac{2}{3(x-1)^5}\Big)H(0;\alpha_0)+\Big(-\frac{2\alpha_0d_1}{3(x-1)^4}+\frac{2d_1}{3(x-1)^4}+\frac{2\alpha_0d_1}{3(x-1)^5}+\frac{2d_1}{3(x-1)^5}\Big)H(1;\alpha_0)-$$

$$\frac{32}{9(x-2)}+\frac{43}{12(x-1)}+\frac{40}{9(x-2)^2}-\frac{4}{9(x-1)^2}-\frac{80}{9(x-2)^3}-\frac{1}{36(x-1)^3}-\frac{160}{3(x-2)^4}-\frac{23}{12(x-1)^4}-\frac{320}{3(x-2)^5}-\frac{17}{12(x-1)^5}+$$

$$\frac12\Big)H(c_1(\alpha_0);x)+\Big(-\frac{32\kappa\alpha_0}{3(x-2)^4}-\frac{64\kappa\alpha_0}{3(x-2)^5}+\frac{32d_1\alpha_0}{3(x-2)^4}+\frac{544\alpha_0}{9(x-2)^4}+\frac{64d_1\alpha_0}{3(x-2)^5}+\frac{1088\alpha_0}{9(x-2)^5}+\frac{32\kappa}{3(x-2)^4}+\frac{128\kappa}{3(x-2)^5}+$$

$$\frac{128\kappa}{3(x-2)^6}+\Big(-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{160\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{160\kappa}{3(x-2)^4}+\frac{640\kappa}{3(x-2)^5}+\frac{640\kappa}{3(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{640}{3(x-2)^5}+$$

$$\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{160\alpha_0d_1}{3(x-2)^4}+\frac{160d_1}{3(x-2)^4}-\frac{320\alpha_0d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}\Big)H(1;\alpha_0)-\frac{32d_1}{3(x-2)^4}-$$

$$\frac{544}{9(x-2)^4}-\frac{128d_1}{3(x-2)^5}-\frac{2176}{9(x-2)^5}-\frac{128d_1}{3(x-2)^6}-\frac{2176}{9(x-2)^6}\Big)H(c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{2x\kappa\alpha_0}{3}-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{2\kappa\alpha_0}{3(x-1)^4}-$$

$$\frac{320\kappa\alpha_0}{3(x-2)^5}+\frac{2\kappa\alpha_0}{3(x-1)^5}+\frac{4\kappa\alpha_0}{3}-\frac{160\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{2x\kappa}{3}+\frac{160\kappa}{3(x-2)^4}+\frac{2\kappa}{3(x-1)^4}+$$

$$\frac{640\kappa}{3(x-2)^5}+\frac{2\kappa}{3(x-1)^5}+\frac{640\kappa}{3(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}+\frac{2}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Big)H(0,0;\alpha_0)+\Big(-\frac{2x\alpha_0}{3}-$$

$$\frac{2x\kappa\alpha_0}{3}+\frac{160\kappa\alpha_0}{3(x-2)^4}+\frac{2\kappa\alpha_0}{3(x-1)^4}+\frac{320\kappa\alpha_0}{3(x-2)^5}-\frac{2\kappa\alpha_0}{3(x-1)^5}+\frac{4\kappa\alpha_0}{3}+\frac{160\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+$$

$$\frac{2x}{3}+\frac{2x\kappa}{3}-\frac{160\kappa}{3(x-2)^4}-\frac{2\kappa}{3(x-1)^4}-\frac{640\kappa}{3(x-2)^5}-\frac{2\kappa}{3(x-1)^5}-\frac{640\kappa}{3(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{2}{3(x-1)^4}-\frac{640}{3(x-2)^5}-\frac{2}{3(x-1)^5}-$$

$$\frac{640}{3(x-2)^6}\Big)H(0,0;x)+\Big(\frac{4\alpha_0d_1}{3}-\frac{2\alpha_0xd_1}{3}+\frac{2xd_1}{3}-\frac{160\alpha_0d_1}{3(x-2)^4}+\frac{160d_1}{3(x-2)^4}-\frac{2\alpha_0d_1}{3(x-1)^4}+\frac{2d_1}{3(x-1)^4}-\frac{320\alpha_0d_1}{3(x-2)^5}+$$

$$\frac{640d_1}{3(x-2)^5}+\frac{2\alpha_0d_1}{3(x-1)^5}+\frac{2d_1}{3(x-1)^5}+\frac{640d_1}{3(x-2)^6}\Big)H(0,1;\alpha_0)+\Big(\frac{x\alpha_0}{3}+\frac{x\kappa\alpha_0}{3}+\frac{80\kappa\alpha_0}{3(x-2)^4}-\frac{\kappa\alpha_0}{3(x-1)^4}+\frac{160\kappa\alpha_0}{3(x-2)^5}+\frac{\kappa\alpha_0}{3(x-1)^5}-$$

$$\frac{2\kappa\alpha_0}{3}+\frac{80\alpha_0}{3(x-2)^4}-\frac{\alpha_0}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}+\frac{\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3}-\frac{x}{3}-\frac{x\kappa}{3}-\frac{80\kappa}{3(x-2)^4}+\frac{\kappa}{3(x-1)^4}-\frac{320\kappa}{3(x-2)^5}+\frac{\kappa}{3(x-1)^5}-$$

$$\frac{320\kappa}{3(x-2)^6}-\frac{80}{3(x-2)^4}+\frac{1}{3(x-1)^4}-\frac{320}{3(x-2)^5}+\frac{1}{3(x-1)^5}-\frac{320}{3(x-2)^6}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{160\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{3(x-2)^5}-$$

$$\frac{160\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{160\kappa}{3(x-2)^4}+\frac{640\kappa}{3(x-2)^5}+\frac{640\kappa}{3(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{640}{3(x-2)^5}+\frac{640}{3(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(-$$

$$\frac{x\alpha_0}{3}-\frac{x\kappa\alpha_0}{3}-\frac{80\kappa\alpha_0}{3(x-2)^4}+\frac{\kappa\alpha_0}{3(x-1)^4}-\frac{160\kappa\alpha_0}{3(x-2)^5}-\frac{\kappa\alpha_0}{3(x-1)^5}+\frac{2\kappa\alpha_0}{3}-\frac{80\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+$$

$$\frac{2d_1\alpha_0}{3(x-1)^5} - \frac{\alpha_0}{3(x-1)^5} + \frac{2\alpha_0}{3} + \frac{x}{3} + \frac{x\kappa}{3} + \frac{80\kappa}{3(x-2)^4} - \frac{\kappa}{3(x-1)^4} + \frac{320\kappa}{3(x-2)^5} - \frac{\kappa}{3(x-1)^5} + \frac{320\kappa}{3(x-2)^6} + \frac{80}{3(x-2)^4} + \frac{2d_1}{3(x-1)^4} -$$

$$\frac{1}{3(x-1)^4} + \frac{320}{3(x-2)^5} + \frac{2d_1}{3(x-1)^5} - \frac{1}{3(x-1)^5} + \frac{320}{3(x-2)^6}\Bigr) H(1,0;x) + \Bigl(\frac{x\alpha_0}{3} + \frac{x\kappa\alpha_0}{3} + \frac{80\kappa\alpha_0}{3(x-2)^4} - \frac{\kappa\alpha_0}{3(x-1)^4} +$$

$$\frac{160\kappa\alpha_0}{3(x-2)^5} + \frac{\kappa\alpha_0}{3(x-1)^5} - \frac{2\kappa\alpha_0}{3} + \frac{80\alpha_0}{3(x-2)^4} + \frac{2d_1\alpha_0}{3(x-1)^4} - \frac{\alpha_0}{3(x-1)^4} + \frac{160\alpha_0}{3(x-2)^5} - \frac{2d_1\alpha_0}{3(x-1)^5} + \frac{\alpha_0}{3(x-1)^5} - \frac{2\alpha_0}{3} - \frac{x}{3} - \frac{x\kappa}{3} -$$

$$\frac{80\kappa}{3(x-2)^4} + \frac{\kappa}{3(x-1)^4} - \frac{320\kappa}{3(x-2)^5} + \frac{\kappa}{3(x-1)^5} - \frac{320\kappa}{3(x-2)^6} - \frac{80}{3(x-2)^4} - \frac{2d_1}{3(x-1)^4} + \frac{1}{3(x-1)^4} - \frac{320}{3(x-2)^5} - \frac{2d_1}{3(x-1)^5} +$$

$$\frac{1}{3(x-1)^5} - \frac{320}{3(x-2)^6}\Bigr) H(1,c_1(\alpha_0);x) + \Bigl(-\frac{160\kappa\alpha_0}{3(x-2)^4} - \frac{320\kappa\alpha_0}{3(x-2)^5} + \frac{160d_1\alpha_0}{3(x-2)^4} - \frac{160\alpha_0}{3(x-2)^4} + \frac{320d_1\alpha_0}{3(x-2)^5} - \frac{320\alpha_0}{3(x-2)^5} +$$

$$\frac{160\kappa}{3(x-2)^4} + \frac{640\kappa}{3(x-2)^5} + \frac{640\kappa}{3(x-2)^6} - \frac{160d_1}{3(x-2)^4} + \frac{160}{3(x-2)^4} - \frac{640d_1}{3(x-2)^5} + \frac{640}{3(x-2)^5} - \frac{640d_1}{3(x-2)^6} + \frac{640}{3(x-2)^6}\Bigr) H(2,0;x) +$$

$$\Bigl(\frac{160\kappa\alpha_0}{3(x-2)^4} + \frac{320\kappa\alpha_0}{3(x-2)^5} - \frac{160d_1\alpha_0}{3(x-2)^4} + \frac{160\alpha_0}{3(x-2)^4} - \frac{320d_1\alpha_0}{3(x-2)^5} + \frac{320\alpha_0}{3(x-2)^5} - \frac{160\kappa}{3(x-2)^4} - \frac{640\kappa}{3(x-2)^5} - \frac{640\kappa}{3(x-2)^6} + \frac{160d_1}{3(x-2)^4} -$$

$$\frac{160}{3(x-2)^4} + \frac{640d_1}{3(x-2)^5} - \frac{640}{3(x-2)^5} + \frac{640d_1}{3(x-2)^6} - \frac{640}{3(x-2)^6}\Bigr) H(2,c_2(\alpha_0);x) + \Bigl(-\frac{\kappa\alpha_0}{3(x-1)^4} + \frac{\kappa\alpha_0}{3(x-1)^5} - \frac{\alpha_0}{3(x-1)^4} +$$

$$\frac{\alpha_0}{3(x-1)^5} + \frac{\kappa}{3(x-1)^4} + \frac{\kappa}{3(x-1)^5} + \frac{1}{3(x-1)^4} + \frac{1}{3(x-1)^5}\Bigr) H(c_1(\alpha_0),c_1(\alpha_0);x) + \Bigl(-\frac{80\kappa\alpha_0}{3(x-2)^4} - \frac{160\kappa\alpha_0}{3(x-2)^5} -$$

$$\frac{80\alpha_0}{3(x-2)^4} - \frac{160\alpha_0}{3(x-2)^5} + \frac{80\kappa}{3(x-2)^4} + \frac{320\kappa}{3(x-2)^5} + \frac{320\kappa}{3(x-2)^6} + \frac{80}{3(x-2)^4} + \frac{320}{3(x-2)^5} + \frac{320}{3(x-2)^6}\Bigr) H(c_2(\alpha_0),c_1(\alpha_0);x) +$$

$$H(0;x)\Bigl(\frac{17x\alpha_0}{12} + \frac{25x\kappa\alpha_0}{36} + \frac{40\kappa\alpha_0}{9(x-2)} - \frac{65\kappa\alpha_0}{12(x-1)} - \frac{40\kappa\alpha_0}{9(x-2)^2} + \frac{25\kappa\alpha_0}{18(x-1)^2} - \frac{35\kappa\alpha_0}{36(x-1)^3} - \frac{128\kappa\alpha_0}{3(x-2)^4} - \frac{7\kappa\alpha_0}{36(x-1)^4} + \frac{64\kappa\alpha_0}{3(x-2)^5} +$$

$$\frac{25\kappa\alpha_0}{36(x-1)^5} - \frac{8\kappa\alpha_0}{9} + \frac{40\alpha_0}{9(x-2)} - \frac{65\alpha_0}{12(x-1)} - \frac{40\alpha_0}{9(x-2)^2} + \frac{25\alpha_0}{18(x-1)^2} - \frac{35\alpha_0}{36(x-1)^3} - \frac{32d_1\alpha_0}{3(x-2)^4} - \frac{1024\alpha_0}{9(x-2)^4} - \frac{11\alpha_0}{12(x-1)^4} -$$

$$\frac{64d_1\alpha_0}{3(x-2)^5} - \frac{1088\alpha_0}{9(x-2)^5} + \frac{17\alpha_0}{12(x-1)^5} - \frac{160\kappa\ln 2\,\alpha_0}{3(x-2)^4} - \frac{320\kappa\ln 2\,\alpha_0}{3(x-2)^5} - \frac{160\ln 2\,\alpha_0}{3(x-2)^4} - \frac{320\ln 2\,\alpha_0}{3(x-2)^5} - \frac{7\alpha_0}{3} - \frac{17x}{12} - \frac{25x\kappa}{36} +$$

$$\frac{32\kappa}{9(x-2)} - \frac{43\kappa}{12(x-1)} - \frac{40\kappa}{9(x-2)^2} + \frac{4\kappa}{9(x-1)^2} + \frac{80\kappa}{9(x-2)^3} + \frac{\kappa}{36(x-1)^3} + \frac{128\kappa}{3(x-2)^4} + \frac{43\kappa}{36(x-1)^4} + \frac{64\kappa}{(x-2)^5} + \frac{25\kappa}{36(x-1)^5} -$$

$$\frac{128\kappa}{3(x-2)^6} - \frac{\kappa}{2} + \frac{32}{9(x-2)} - \frac{43}{12(x-1)} - \frac{40}{9(x-2)^2} + \frac{4}{9(x-1)^2} + \frac{80}{9(x-2)^3} + \frac{1}{36(x-1)^3} + \frac{32d_1}{3(x-2)^4} + \frac{1024}{9(x-2)^4} + \frac{23}{12(x-1)^4} +$$

$$\frac{128d_1}{3(x-2)^5} + \frac{3136}{9(x-2)^5} + \frac{17}{12(x-1)^5} + \frac{128d_1}{3(x-2)^6} + \frac{2176}{9(x-2)^6} + \frac{160\kappa\ln 2}{3(x-2)^4} + \frac{640\kappa\ln 2}{3(x-2)^5} + \frac{640\kappa\ln 2}{3(x-2)^6} + \frac{160\ln 2}{3(x-2)^4} + \frac{640\ln 2}{3(x-2)^5} +$$

$$\frac{640\ln 2}{3(x-2)^6} - \frac{1}{2}\Bigr) + H(2;x)\Bigl(\frac{160\kappa\ln 2\,\alpha_0}{3(x-2)^4} + \frac{320\kappa\ln 2\,\alpha_0}{3(x-2)^5} - \frac{160d_1\ln 2\,\alpha_0}{3(x-2)^4} + \frac{160\ln 2\,\alpha_0}{3(x-2)^4} - \frac{320d_1\ln 2\,\alpha_0}{3(x-2)^5} + \frac{320\ln 2\,\alpha_0}{3(x-2)^5} +$$

$$\Bigl(\frac{160\kappa\alpha_0}{3(x-2)^4} + \frac{320\kappa\alpha_0}{3(x-2)^5} - \frac{160d_1\alpha_0}{3(x-2)^4} + \frac{160\alpha_0}{3(x-2)^4} - \frac{320d_1\alpha_0}{3(x-2)^5} + \frac{320\alpha_0}{3(x-2)^5} - \frac{160\kappa}{3(x-2)^4} - \frac{640\kappa}{3(x-2)^5} - \frac{640\kappa}{3(x-2)^6} + \frac{160d_1}{3(x-2)^4} -$$

$$\frac{160}{3(x-2)^4} + \frac{640d_1}{3(x-2)^5} - \frac{640}{3(x-2)^5} + \frac{640d_1}{3(x-2)^6} - \frac{640}{3(x-2)^6}\Bigr) H(0;\alpha_0) - \frac{160\kappa\ln 2}{3(x-2)^4} - \frac{640\kappa\ln 2}{3(x-2)^5} - \frac{640\kappa\ln 2}{3(x-2)^6} + \frac{160d_1\ln 2}{3(x-2)^4} -$$

$$\frac{160\ln 2}{3(x-2)^4} + \frac{640d_1\ln 2}{3(x-2)^5} - \frac{640\ln 2}{3(x-2)^5} + \frac{640d_1\ln 2}{3(x-2)^6} - \frac{640\ln 2}{3(x-2)^6}\Bigr) + \frac{40x}{27(\kappa+1)} + \frac{\pi^2x\kappa}{6(\kappa+1)} - \frac{20\pi^2\kappa}{3(x-2)^4(\kappa+1)} - \frac{\pi^2\kappa}{6(x-1)^4(\kappa+1)} -$$

$$\frac{80\pi^2\kappa}{3(x-2)^5(\kappa+1)} - \frac{\pi^2\kappa}{6(x-1)^5(\kappa+1)} - \frac{80\pi^2\kappa}{3(x-2)^6(\kappa+1)} - \frac{20\pi^2}{9(x-2)^4(\kappa+1)} - \frac{\pi^2}{18(x-1)^4(\kappa+1)} - \frac{80\pi^2}{9(x-2)^5(\kappa+1)} -$$

$$\frac{\pi^2}{18(x-1)^5(\kappa+1)} - \frac{80\pi^2}{9(x-2)^6(\kappa+1)} - \frac{80\kappa\ln^2 2}{(x-2)^4(\kappa+1)} - \frac{320\kappa\ln^2 2}{(x-2)^5(\kappa+1)} - \frac{320\kappa\ln^2 2}{(x-2)^6(\kappa+1)} - \frac{80\ln^2 2}{3(x-2)^4(\kappa+1)} - \frac{320\ln^2 2}{3(x-2)^5(\kappa+1)} -$$

$$\frac{320\ln^2 2}{3(x-2)^6(\kappa+1)} - \frac{32d_1\kappa\ln 2}{3(x-2)^4(\kappa+1)} - \frac{352\kappa\ln 2}{9(x-2)^4(\kappa+1)} - \frac{128d_1\kappa\ln 2}{3(x-2)^5(\kappa+1)} - \frac{1408\kappa\ln 2}{9(x-2)^5(\kappa+1)} - \frac{128d_1\kappa\ln 2}{3(x-2)^6(\kappa+1)} - \frac{1408\kappa\ln 2}{9(x-2)^6(\kappa+1)} -$$

$$\frac{32d_1\ln 2}{3(x-2)^4(\kappa+1)} - \frac{544\ln 2}{9(x-2)^4(\kappa+1)} - \frac{128d_1\ln 2}{3(x-2)^5(\kappa+1)} - \frac{2176\ln 2}{9(x-2)^5(\kappa+1)} - \frac{128d_1\ln 2}{3(x-2)^6(\kappa+1)} - \frac{2176\ln 2}{9(x-2)^6(\kappa+1)}\Bigr\},$$

$$a_2^{(\kappa,2)} = \frac{1}{\alpha_0(x-2)-x}\Bigl\{\frac{1}{48}d_1^2x\alpha_0^5 - \frac{1}{72}\pi^2x\alpha_0^5 + \frac{d_1^2\alpha_0^5}{24(x-2)} - \frac{\pi^2\alpha_0^5}{36(x-2)} - \frac{d_1^2\alpha_0^5}{48(x-1)} + \frac{\pi^2\alpha_0^5}{72(x-1)} - \frac{d_1\alpha_0^5}{48(\kappa+1)} -$$

$$\frac{19d_1x\alpha_0^5}{144(\kappa+1)} + \frac{13x\alpha_0^5}{27(\kappa+1)} - \frac{d_1\kappa\alpha_0^5}{48(\kappa+1)} - \frac{31d_1x\kappa\alpha_0^5}{144(\kappa+1)} + \frac{85x\kappa\alpha_0^5}{108(\kappa+1)} - \frac{17d_1\kappa\alpha_0^5}{36(x-2)(\kappa+1)} + \frac{415\kappa\alpha_0^5}{216(x-2)(\kappa+1)} + \frac{31d_1\kappa\alpha_0^5}{144(x-1)(\kappa+1)} -$$

$$\frac{85\kappa\alpha_0^5}{108(x-1)(\kappa+1)} + \frac{25\kappa\alpha_0^5}{144(\kappa+1)} - \frac{11d_1\alpha_0^5}{36(x-2)(\kappa+1)} + \frac{265\alpha_0^5}{216(x-2)(\kappa+1)} + \frac{19d_1\alpha_0^5}{144(x-1)(\kappa+1)} - \frac{13\alpha_0^5}{27(x-1)(\kappa+1)} + \frac{19\alpha_0^5}{144(\kappa+1)} +$$

$$\frac{37d_1^2\alpha_0^4}{648} - \frac{199d_1^2x\alpha_0^4}{1296} + \frac{19}{216}\pi^2x\alpha_0^4 - \frac{17d_1^2\alpha_0^4}{324(x-2)} + \frac{5\pi^2\alpha_0^4}{54(x-2)} + \frac{145d_1^2\alpha_0^4}{1296(x-1)} - \frac{13\pi^2\alpha_0^4}{216(x-1)} - \frac{79d_1\alpha_0^4}{432(\kappa+1)} + \frac{137d_1x\alpha_0^4}{144(\kappa+1)} -$$

$$\frac{173x\alpha_0^4}{54(\kappa+1)} - \frac{617d_1\kappa\alpha_0^4}{1296(\kappa+1)} + \frac{2113d_1x\kappa\alpha_0^4}{1296(\kappa+1)} - \frac{1835x\kappa\alpha_0^4}{324(\kappa+1)} + \frac{139d_1\kappa\alpha_0^4}{162(x-2)(\kappa+1)} - \frac{1687\kappa\alpha_0^4}{324(x-2)(\kappa+1)} - \frac{1429d_1\kappa\alpha_0^4}{1296(x-1)(\kappa+1)} +$$

$$\frac{2359\kappa\alpha_0^4}{648(x-1)(\kappa+1)} - \frac{487d_1\kappa\alpha_0^4}{162(x-2)^2(\kappa+1)} + \frac{2851\kappa\alpha_0^4}{324(x-2)^2(\kappa+1)} + \frac{359d_1\kappa\alpha_0^4}{648(x-1)^2(\kappa+1)} - \frac{140\kappa\alpha_0^4}{81(x-1)^2(\kappa+1)} + \frac{733\kappa\alpha_0^4}{1296(\kappa+1)} +$$

$$\frac{35d_1\alpha_0^4}{54(x-2)(\kappa+1)} - \frac{137\alpha_0^4}{36(x-2)(\kappa+1)} - \frac{283d_1\alpha_0^4}{432(x-1)(\kappa+1)} + \frac{461\alpha_0^4}{216(x-1)(\kappa+1)} - \frac{95d_1\alpha_0^4}{54(x-2)^2(\kappa+1)} + \frac{503\alpha_0^4}{108(x-2)^2(\kappa+1)} +$$

$$\frac{7d_1\alpha_0^4}{24(x-1)^2(\kappa+1)} - \frac{43\alpha_0^4}{54(x-1)^2(\kappa+1)} - \frac{59\alpha_0^4}{432(\kappa+1)} + \frac{101d_1^2\alpha_0^4}{324(x-2)^2} - \frac{5\pi^2\alpha_0^4}{54(x-2)^2} - \frac{4d_1^2\alpha_0^4}{81(x-1)^2} + \frac{\pi^2\alpha_0^4}{54(x-1)^2} - \frac{\pi^2\alpha_0^4}{108} - \frac{25d_1^2\alpha_0^3}{54} +$$

$$\frac{371}{648}d_1^2 x\alpha_0^3 - \frac{13}{54}\pi^2 x\alpha_0^3 - \frac{67d_1^2\alpha_0^3}{324(x-2)} - \frac{5\pi^2\alpha_0^3}{54(x-2)} - \frac{155d_1^2\alpha_0^3}{648(x-1)} + \frac{11\pi^2\alpha_0^3}{108(x-1)} + \frac{437d_1\alpha_0^3}{216(\kappa+1)} - \frac{1441d_1x\alpha_0^3}{432(\kappa+1)} + \frac{521x\alpha_0^3}{54(\kappa+1)} +$$
$$\frac{985d_1\kappa\alpha_0^3}{216(\kappa+1)} - \frac{8029d_1x\kappa\alpha_0^3}{1296(\kappa+1)} + \frac{6347x\kappa\alpha_0^3}{324(\kappa+1)} + \frac{769d_1\kappa\alpha_0^3}{324(x-2)(\kappa+1)} - \frac{182\kappa\alpha_0^3}{81(x-2)(\kappa+1)} + \frac{139d_1\kappa\alpha_0^3}{81(x-1)(\kappa+1)} - \frac{3085\kappa\alpha_0^3}{648(x-1)(\kappa+1)} -$$
$$\frac{110d_1\kappa\alpha_0^3}{81(x-2)^2(\kappa+1)} - \frac{509\kappa\alpha_0^3}{81(x-2)^2(\kappa+1)} - \frac{3677d_1\kappa\alpha_0^3}{1296(x-1)^2(\kappa+1)} + \frac{10099\kappa\alpha_0^3}{1296(x-1)^2(\kappa+1)} - \frac{2168d_1\kappa\alpha_0^3}{81(x-2)^3(\kappa+1)} + \frac{4684\kappa\alpha_0^3}{81(x-2)^3(\kappa+1)} +$$
$$\frac{263d_1\kappa\alpha_0^3}{144(x-1)^3(\kappa+1)} - \frac{173\kappa\alpha_0^3}{36(x-1)^3(\kappa+1)} - \frac{4183\kappa\alpha_0^3}{432(\kappa+1)} + \frac{89d_1\alpha_0^3}{108(x-2)(\kappa+1)} + \frac{58\alpha_0^3}{27(x-2)(\kappa+1)} + \frac{121d_1\alpha_0^3}{108(x-1)(\kappa+1)} -$$
$$\frac{239\alpha_0^3}{72(x-1)(\kappa+1)} + \frac{2d_1\alpha_0^3}{27(x-2)^2(\kappa+1)} - \frac{185\alpha_0^3}{27(x-2)^2(\kappa+1)} - \frac{605d_1\alpha_0^3}{432(x-1)^2(\kappa+1)} + \frac{1351\alpha_0^3}{432(x-1)^2(\kappa+1)} - \frac{376d_1\alpha_0^3}{27(x-2)^3(\kappa+1)} +$$
$$\frac{212\alpha_0^3}{9(x-2)^3(\kappa+1)} + \frac{367d_1\alpha_0^3}{432(x-1)^3(\kappa+1)} - \frac{89\alpha_0^3}{54(x-1)^3(\kappa+1)} - \frac{1021\alpha_0^3}{432(\kappa+1)} + \frac{29d_1^2\alpha_0^3}{81(x-2)^2} + \frac{5\pi^2\alpha_0^3}{27(x-2)^2} + \frac{43d_1^2\alpha_0^3}{162(x-1)^2} -$$
$$\frac{7\pi^2\alpha_0^3}{108(x-1)^2} + \frac{260d_1^2\alpha_0^3}{81(x-2)^3} - \frac{10\pi^2\alpha_0^3}{27(x-2)^3} - \frac{d_1^2\alpha_0^3}{6(x-1)^3} + \frac{\pi^2\alpha_0^3}{36(x-1)^3} + \frac{\pi^2\alpha_0^3}{18} + \frac{365d_1^2\alpha_0^2}{108} - \frac{505}{216}d_1^2x\alpha_0^2 + \frac{7}{18}\pi^2x\alpha_0^2 +$$
$$\frac{14d_1^2\alpha_0^2}{27(x-2)} + \frac{55d_1^2\alpha_0^2}{216(x-1)} - \frac{\pi^2\alpha_0^2}{12(x-1)} - \frac{1445d_1\alpha_0^2}{108(\kappa+1)} + \frac{4637d_1x\alpha_0^2}{432(\kappa+1)} - \frac{497x\alpha_0^2}{24(\kappa+1)} - \frac{1735d_1\kappa\alpha_0^2}{54(\kappa+1)} + \frac{10115d_1x\kappa\alpha_0^2}{432(\kappa+1)} - \frac{12541x\kappa\alpha_0^2}{216(\kappa+1)} -$$
$$\frac{458d_1\kappa\alpha_0^2}{27(x-2)(\kappa+1)} + \frac{1280\kappa\alpha_0^2}{27(x-2)(\kappa+1)} + \frac{1619d_1\kappa\alpha_0^2}{216(x-1)(\kappa+1)} - \frac{575\kappa\alpha_0^2}{24(x-1)(\kappa+1)} + \frac{737d_1\kappa\alpha_0^2}{18(x-2)^2(\kappa+1)} - \frac{821\kappa\alpha_0^2}{9(x-2)^2(\kappa+1)} +$$
$$\frac{569d_1\kappa\alpha_0^2}{144(x-1)^2(\kappa+1)} - \frac{3731\kappa\alpha_0^2}{432(x-1)^2(\kappa+1)} - \frac{5344d_1\kappa\alpha_0^2}{27(x-2)^3(\kappa+1)} + \frac{7408\kappa\alpha_0^2}{27(x-2)^3(\kappa+1)} - \frac{2093d_1\kappa\alpha_0^2}{144(x-1)^3(\kappa+1)} + \frac{743\kappa\alpha_0^2}{24(x-1)^3(\kappa+1)} -$$
$$\frac{5008d_1\kappa\alpha_0^2}{9(x-2)^4(\kappa+1)} + \frac{24184\kappa\alpha_0^2}{27(x-2)^4(\kappa+1)} + \frac{299d_1\kappa\alpha_0^2}{24(x-1)^4(\kappa+1)} - \frac{1829\kappa\alpha_0^2}{72(x-1)^4(\kappa+1)} + \frac{28453\kappa\alpha_0^2}{432(\kappa+1)} - \frac{58d_1\alpha_0^2}{9(x-2)(\kappa+1)} + \frac{256\alpha_0^2}{27(x-2)(\kappa+1)} +$$
$$\frac{427d_1\alpha_0^2}{216(x-1)(\kappa+1)} - \frac{61\alpha_0^2}{24(x-1)(\kappa+1)} + \frac{299d_1\alpha_0^2}{18(x-2)^2(\kappa+1)} - \frac{163\alpha_0^2}{9(x-2)^2(\kappa+1)} + \frac{881d_1\alpha_0^2}{432(x-1)^2(\kappa+1)} - \frac{1621\alpha_0^2}{432(x-1)^2(\kappa+1)} -$$
$$\frac{736d_1\alpha_0^2}{9(x-2)^3(\kappa+1)} + \frac{1424\alpha_0^2}{27(x-2)^3(\kappa+1)} - \frac{871d_1\alpha_0^2}{144(x-1)^3(\kappa+1)} + \frac{569\alpha_0^2}{72(x-1)^3(\kappa+1)} - \frac{2224d_1\alpha_0^2}{9(x-2)^4(\kappa+1)} + \frac{6664\alpha_0^2}{27(x-2)^4(\kappa+1)} +$$
$$\frac{1105d_1\alpha_0^2}{216(x-1)^4(\kappa+1)} - \frac{1333\alpha_0^2}{216(x-1)^4(\kappa+1)} + \frac{6791\alpha_0^2}{432(\kappa+1)} - \frac{53d_1^2\alpha_0^2}{18(x-2)^2} - \frac{d_1^2\alpha_0^2}{2(x-1)^2} + \frac{\pi^2\alpha_0^2}{12(x-1)^2} + \frac{784d_1^2\alpha_0^2}{27(x-2)^3} + \frac{3d_1^2\alpha_0^2}{2(x-1)^3} -$$
$$\frac{\pi^2\alpha_0^2}{12(x-1)^3} + \frac{232d_1^2\alpha_0^2}{3(x-2)^4} - \frac{20\pi^2\alpha_0^2}{9(x-2)^4} - \frac{4d_1^2\alpha_0^2}{3(x-1)^4} + \frac{\pi^2\alpha_0^2}{18(x-1)^4} - \frac{\pi^2\alpha_0^2}{6} + \frac{d_1^2\alpha_0}{6(\kappa+1)} - \frac{263d_1\alpha_0}{216(\kappa+1)} + \frac{205d_1^2x\alpha_0}{108(\kappa+1)} - \frac{1775d_1x\alpha_0}{216(\kappa+1)} -$$
$$\frac{73\pi^2x\alpha_0}{216(\kappa+1)} + \frac{6995x\alpha_0}{648(\kappa+1)} + \frac{d_1^2\kappa\alpha_0}{6(\kappa+1)} - \frac{49d_1\kappa\alpha_0}{24(\kappa+1)} + \frac{205d_1^2x\kappa\alpha_0}{108(\kappa+1)} - \frac{4025d_1x\kappa\alpha_0}{216(\kappa+1)} - \frac{301\pi^2x\kappa\alpha_0}{216(\kappa+1)} + \frac{3121x\kappa\alpha_0}{72(\kappa+1)} - \frac{7d_1^2\kappa\alpha_0}{27(x-2)(\kappa+1)} -$$
$$\frac{86d_1\kappa\alpha_0}{27(x-2)(\kappa+1)} - \frac{140\pi^2\kappa\alpha_0}{27(x-2)(\kappa+1)} + \frac{320\kappa\alpha_0}{27(x-2)(\kappa+1)} - \frac{7d_1^2\kappa\alpha_0}{108(x-1)(\kappa+1)} + \frac{1787d_1\kappa\alpha_0}{216(x-1)(\kappa+1)} + \frac{455\pi^2\kappa\alpha_0}{72(x-1)(\kappa+1)} -$$
$$\frac{865\kappa\alpha_0}{36(x-1)(\kappa+1)} + \frac{53d_1^2\kappa\alpha_0}{27(x-2)^2(\kappa+1)} - \frac{239d_1\kappa\alpha_0}{27(x-2)^2(\kappa+1)} + \frac{140\pi^2\kappa\alpha_0}{27(x-2)^2(\kappa+1)} + \frac{5d_1^2\kappa\alpha_0}{27(x-1)^2(\kappa+1)} - \frac{889d_1\kappa\alpha_0}{216(x-1)^2(\kappa+1)} -$$
$$\frac{175\pi^2\kappa\alpha_0}{108(x-1)^2(\kappa+1)} + \frac{1315\kappa\alpha_0}{108(x-1)^2(\kappa+1)} - \frac{784d_1^2\kappa\alpha_0}{27(x-2)^3(\kappa+1)} + \frac{4168d_1\kappa\alpha_0}{27(x-2)^3(\kappa+1)} - \frac{3704\kappa\alpha_0}{27(x-2)^3(\kappa+1)} - \frac{d_1^2\kappa\alpha_0}{(x-1)^3(\kappa+1)} +$$
$$\frac{77d_1\kappa\alpha_0}{9(x-1)^3(\kappa+1)} + \frac{245\pi^2\kappa\alpha_0}{216(x-1)^3(\kappa+1)} - \frac{361\kappa\alpha_0}{24(x-1)^3(\kappa+1)} - \frac{464d_1^2\kappa\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{10016d_1\kappa\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{8d_1\pi^2\kappa\alpha_0}{3(x-2)^4(\kappa+1)} +$$
$$\frac{704\pi^2\kappa\alpha_0}{9(x-2)^4(\kappa+1)} - \frac{48368\kappa\alpha_0}{27(x-2)^4(\kappa+1)} - \frac{4d_1^2\kappa\alpha_0}{3(x-1)^4(\kappa+1)} + \frac{299d_1\kappa\alpha_0}{24(x-1)^4(\kappa+1)} + \frac{139\pi^2\kappa\alpha_0}{216(x-1)^4(\kappa+1)} - \frac{1829\kappa\alpha_0}{72(x-1)^4(\kappa+1)} -$$
$$\frac{512d_1^2\kappa\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{11264d_1\kappa\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{16d_1\pi^2\kappa\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{32\pi^2\kappa\alpha_0}{(x-2)^5(\kappa+1)} - \frac{59008\kappa\alpha_0}{27(x-2)^5(\kappa+1)} - \frac{253\pi^2\kappa\alpha_0}{216(x-1)^5(\kappa+1)} + \frac{89\pi^2\kappa\alpha_0}{54(\kappa+1)} +$$
$$\frac{307\kappa\alpha_0}{36(\kappa+1)} - \frac{7d_1^2\alpha_0}{27(x-2)(\kappa+1)} - \frac{2d_1\alpha_0}{3(x-2)(\kappa+1)} - \frac{20\pi^2\alpha_0}{27(x-2)(\kappa+1)} + \frac{64\alpha_0}{27(x-2)(\kappa+1)} - \frac{7d_1^2\alpha_0}{108(x-1)(\kappa+1)} + \frac{613d_1\alpha_0}{216(x-1)(\kappa+1)} +$$
$$\frac{65\pi^2\alpha_0}{72(x-1)(\kappa+1)} - \frac{19\alpha_0}{4(x-1)(\kappa+1)} + \frac{53d_1^2\alpha_0}{27(x-2)^2(\kappa+1)} - \frac{133d_1\alpha_0}{27(x-2)^2(\kappa+1)} + \frac{20\pi^2\alpha_0}{27(x-2)^2(\kappa+1)} + \frac{5d_1^2\alpha_0}{27(x-1)^2(\kappa+1)} -$$
$$\frac{331d_1\alpha_0}{216(x-1)^2(\kappa+1)} - \frac{25\pi^2\alpha_0}{108(x-1)^2(\kappa+1)} + \frac{257\alpha_0}{108(x-1)^2(\kappa+1)} - \frac{784d_1^2\alpha_0}{27(x-2)^3(\kappa+1)} + \frac{1816d_1\alpha_0}{27(x-2)^3(\kappa+1)} - \frac{712\alpha_0}{27(x-2)^3(\kappa+1)} -$$
$$\frac{d_1^2\alpha_0}{(x-1)^3(\kappa+1)} + \frac{10d_1\alpha_0}{3(x-1)^3(\kappa+1)} + \frac{35\pi^2\alpha_0}{216(x-1)^3(\kappa+1)} - \frac{67\alpha_0}{24(x-1)^3(\kappa+1)} - \frac{464d_1^2\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{4448d_1\alpha_0}{9(x-2)^4(\kappa+1)} +$$
$$\frac{8d_1\pi^2\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{496\pi^2\alpha_0}{27(x-2)^4(\kappa+1)} - \frac{13328\alpha_0}{27(x-2)^4(\kappa+1)} - \frac{4d_1^2\alpha_0}{3(x-1)^4(\kappa+1)} + \frac{1105d_1\alpha_0}{216(x-1)^4(\kappa+1)} + \frac{5\pi^2\alpha_0}{24(x-1)^4(\kappa+1)} -$$
$$\frac{1333\alpha_0}{216(x-1)^4(\kappa+1)} - \frac{512d_1^2\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{5120d_1\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{16d_1\pi^2\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{512\pi^2\alpha_0}{27(x-2)^5(\kappa+1)} - \frac{19072\alpha_0}{27(x-2)^5(\kappa+1)} -$$
$$\frac{17\pi^2\alpha_0}{72(x-1)^5(\kappa+1)} + \frac{\pi^2\alpha_0}{27(\kappa+1)} + \frac{3505\alpha_0}{324(\kappa+1)} + \frac{x\zeta_3\alpha_0}{\kappa+1} + \frac{7x\kappa\zeta_3\alpha_0}{3(\kappa+1)} - \frac{7\kappa\zeta_3\alpha_0}{3(x-1)^4(\kappa+1)} + \frac{7\kappa\zeta_3\alpha_0}{3(x-1)^5(\kappa+1)} - \frac{14\kappa\zeta_3\alpha_0}{3(\kappa+1)} -$$
$$\frac{\zeta_3\alpha_0}{3(x-1)^4(\kappa+1)} + \frac{\zeta_3\alpha_0}{3(x-1)^5(\kappa+1)} - \frac{2\zeta_3\alpha_0}{\kappa+1} + \frac{1120\kappa\ln^3 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{2240\kappa\ln^3 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{160\ln^3 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{320\ln^3 2\,\alpha_0}{9(x-2)^5(\kappa+1)} +$$
$$\frac{32d_1\kappa\ln^2 2\,\alpha_0}{(x-2)^4(\kappa+1)} + \frac{416\kappa\ln^2 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{64d_1\kappa\ln^2 2\,\alpha_0}{(x-2)^5(\kappa+1)} + \frac{832\kappa\ln^2 2\,\alpha_0}{3(x-2)^5(\kappa+1)} + \frac{32d_1\ln^2 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{544\ln^2 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{64d_1\ln^2 2\,\alpha_0}{3(x-2)^5(\kappa+1)} +$$
$$\frac{1088\ln^2 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{256d_1\kappa\ln 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{80\pi^2\kappa\ln 2\,\alpha_0}{3(x-2)^4(\kappa+1)} + \frac{1856\kappa\ln 2\,\alpha_0}{27(x-2)^4(\kappa+1)} + \frac{512d_1\kappa\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{160\pi^2\kappa\ln 2\,\alpha_0}{3(x-2)^5(\kappa+1)} +$$
$$\frac{3712\kappa\ln 2\,\alpha_0}{27(x-2)^5(\kappa+1)} + \frac{256d_1\ln 2\,\alpha_0}{9(x-2)^4(\kappa+1)} + \frac{3392\ln 2\,\alpha_0}{27(x-2)^4(\kappa+1)} + \frac{512d_1\ln 2\,\alpha_0}{9(x-2)^5(\kappa+1)} + \frac{6784\ln 2\,\alpha_0}{27(x-2)^5(\kappa+1)} + \left(\frac{1}{12}d_1x\alpha_0^5 - \frac{4x\alpha_0^5}{9} + \right.$$

$$\frac{1}{12} d_1 x\kappa\alpha_0^5 - \frac{11}{18}x\kappa\alpha_0^5 + \frac{d_1\kappa\alpha_0^5}{6(x-2)} - \frac{25\kappa\alpha_0^5}{18(x-2)} - \frac{d_1\kappa\alpha_0^5}{12(x-1)} + \frac{11\kappa\alpha_0^5}{18(x-1)} - \frac{\kappa\alpha_0^5}{12} + \frac{d_1\alpha_0^5}{6(x-2)} - \frac{19\alpha_0^5}{18(x-2)} - \frac{d_1\alpha_0^5}{12(x-1)} + \frac{4\alpha_0^5}{9(x-1)} -$$

$$\frac{\alpha_0^5}{12} + \frac{7d_1\alpha_0^4}{54} - \frac{61}{108}d_1 x\alpha_0^4 + \frac{157x\alpha_0^4}{54} + \frac{7}{54}d_1\kappa\alpha_0^4 - \frac{61}{108}d_1x\kappa\alpha_0^4 + \frac{112}{27}x\kappa\alpha_0^4 - \frac{11d_1\kappa\alpha_0^4}{27(x-2)} + \frac{113\kappa\alpha_0^4}{27(x-2)} + \frac{43d_1\kappa\alpha_0^4}{108(x-1)} -$$

$$\frac{149\kappa\alpha_0^4}{54(x-1)} + \frac{23d_1\kappa\alpha_0^4}{27(x-2)^2} - \frac{149\kappa\alpha_0^4}{27(x-2)^2} - \frac{4d_1\kappa\alpha_0^4}{27(x-1)^2} + \frac{59\kappa\alpha_0^4}{54(x-1)^2} - \frac{41\kappa\alpha_0^4}{108} - \frac{11d_1\alpha_0^4}{27(x-2)} + \frac{91\alpha_0^4}{27(x-2)} + \frac{43d_1\alpha_0^4}{108(x-1)} - \frac{53\alpha_0^4}{27(x-1)} +$$

$$\frac{23d_1\alpha_0^4}{27(x-2)^2} - \frac{103\alpha_0^4}{27(x-2)^2} - \frac{4d_1\alpha_0^4}{27(x-1)^2} + \frac{37\alpha_0^4}{54(x-1)^2} - \frac{\alpha_0^4}{108} - \frac{8d_1\alpha_0^3}{9} + \frac{95}{54}d_1x\alpha_0^3 - \frac{911x\alpha_0^3}{108} - \frac{8}{9}d_1\kappa\alpha_0^3 + \frac{95}{54}d_1x\kappa\alpha_0^3 -$$

$$\frac{1381}{108}x\kappa\alpha_0^3 - \frac{d_1\kappa\alpha_0^3}{27(x-2)} - \frac{50\kappa\alpha_0^3}{27(x-2)} - \frac{41d_1\kappa\alpha_0^3}{54(x-1)} + \frac{239\kappa\alpha_0^3}{54(x-1)} - \frac{16d_1\kappa\alpha_0^3}{27(x-2)^2} + \frac{208\kappa\alpha_0^3}{27(x-2)^2} + \frac{17d_1\kappa\alpha_0^3}{27(x-1)^2} - \frac{467\kappa\alpha_0^3}{108(x-1)^2} +$$

$$\frac{152d_1\kappa\alpha_0^3}{27(x-2)^3} - \frac{776\kappa\alpha_0^3}{27(x-2)^3} - \frac{d_1\kappa\alpha_0^3}{3(x-1)^3} + \frac{83\kappa\alpha_0^3}{36(x-1)^3} + \frac{83\kappa\alpha_0^3}{18} - \frac{d_1\alpha_0^3}{27(x-2)} - \frac{70\alpha_0^3}{27(x-2)} - \frac{41d_1\alpha_0^3}{54(x-1)} + \frac{175\alpha_0^3}{54(x-1)} - \frac{16d_1\alpha_0^3}{27(x-2)^2} +$$

$$\frac{176\alpha_0^3}{27(x-2)^2} + \frac{17d_1\alpha_0^3}{27(x-1)^2} - \frac{277\alpha_0^3}{108(x-1)^2} + \frac{152d_1\alpha_0^3}{27(x-2)^3} - \frac{472\alpha_0^3}{27(x-2)^3} - \frac{d_1\alpha_0^3}{3(x-1)^3} + \frac{5\alpha_0^3}{4(x-1)^3} + \frac{35\alpha_0^3}{18} + \frac{35d_1\alpha_0^2}{9} - \frac{73}{18}d_1x\alpha_0^2 +$$

$$\frac{569x\alpha_0^2}{36} + \frac{35}{9}d_1\kappa\alpha_0^2 - \frac{73}{18}d_1x\kappa\alpha_0^2 + \frac{979}{36}x\kappa\alpha_0^2 + \frac{8d_1\kappa\alpha_0^2}{9(x-2)} - \frac{32\kappa\alpha_0^2}{3(x-2)} + \frac{13d_1\kappa\alpha_0^2}{18(x-1)} + \frac{4\kappa\alpha_0^2}{3(x-1)} - \frac{10d_1\kappa\alpha_0^2}{3(x-2)^2} + \frac{20\kappa\alpha_0^2}{(x-2)^2} -$$

$$\frac{d_1\kappa\alpha_0^2}{(x-1)^2} + \frac{67\kappa\alpha_0^2}{12(x-1)^2} + \frac{160d_1\kappa\alpha_0^2}{9(x-2)^3} - \frac{160\kappa\alpha_0^2}{3(x-2)^3} + \frac{5d_1\kappa\alpha_0^2}{3(x-1)^3} - \frac{119\kappa\alpha_0^2}{12(x-1)^3} + \frac{208d_1\kappa\alpha_0^2}{3(x-2)^4} - \frac{2512\kappa\alpha_0^2}{9(x-2)^4} - \frac{4d_1\kappa\alpha_0^2}{3(x-1)^4} + \frac{137\kappa\alpha_0^2}{18(x-1)^4} -$$

$$\frac{64\kappa\alpha_0^2}{3} + \frac{8d_1\alpha_0^2}{9(x-2)} - \frac{32\alpha_0^2}{9(x-2)} + \frac{13d_1\alpha_0^2}{18(x-1)} - \frac{\alpha_0^2}{x-1} - \frac{10d_1\alpha_0^2}{3(x-2)^2} + \frac{20\alpha_0^2}{3(x-2)^2} - \frac{d_1\alpha_0^2}{(x-1)^2} + \frac{119\alpha_0^2}{36(x-1)^2} + \frac{160d_1\alpha_0^2}{9(x-2)^3} - \frac{160\alpha_0^2}{9(x-2)^3} +$$

$$\frac{5d_1\alpha_0^2}{3(x-1)^3} - \frac{19\alpha_0^2}{4(x-1)^3} + \frac{208d_1\alpha_0^2}{3(x-2)^4} - \frac{1264\alpha_0^2}{9(x-2)^4} - \frac{4d_1\alpha_0^2}{3(x-1)^4} + \frac{7\alpha_0^2}{2(x-1)^4} - \frac{85\alpha_0^2}{9} - \frac{13d_1\alpha_0}{27} + \frac{805d_1x\alpha_0}{216} - \frac{1}{18}\pi^2x\alpha_0 - \frac{271x\alpha_0}{24} -$$

$$\frac{13d_1\kappa\alpha_0}{27} + \frac{805}{216}d_1x\kappa\alpha_0 - \frac{5131x\kappa\alpha_0}{216} + \frac{380d_1\kappa\alpha_0}{27(x-2)} - \frac{1208\kappa\alpha_0}{27(x-2)} - \frac{379d_1\kappa\alpha_0}{24(x-1)} + \frac{4009\kappa\alpha_0}{72(x-1)} - \frac{332d_1\kappa\alpha_0}{27(x-2)^2} + \frac{1136\kappa\alpha_0}{27(x-2)^2} +$$

$$\frac{205d_1\kappa\alpha_0}{108(x-1)^2} - \frac{713\kappa\alpha_0}{54(x-1)^2} - \frac{160d_1\kappa\alpha_0}{9(x-2)^3} + \frac{80\kappa\alpha_0}{3(x-2)^3} - \frac{395d_1\kappa\alpha_0}{216(x-1)^3} + \frac{2399\kappa\alpha_0}{216(x-1)^3} - \frac{224d_1\kappa\alpha_0}{(x-2)^4} + \frac{928\kappa\alpha_0}{(x-2)^4} - \frac{331d_1\kappa\alpha_0}{216(x-1)^4} +$$

$$\frac{475\kappa\alpha_0}{54(x-1)^4} - \frac{512d_1\kappa\alpha_0}{3(x-2)^5} + \frac{6656\kappa\alpha_0}{9(x-2)^5} + \frac{205d_1\kappa\alpha_0}{216(x-1)^5} - \frac{1255\kappa\alpha_0}{216(x-1)^5} + \frac{203\kappa\alpha_0}{216} + \frac{380d_1\alpha_0}{27(x-2)} - \frac{616\alpha_0}{27(x-2)} - \frac{379d_1\alpha_0}{24(x-1)} + \frac{671\alpha_0}{24(x-1)} -$$

$$\frac{332d_1\alpha_0}{27(x-2)^2} + \frac{592\alpha_0}{27(x-2)^2} + \frac{205d_1\alpha_0}{108(x-1)^2} - \frac{361\alpha_0}{54(x-1)^2} - \frac{160d_1\alpha_0}{9(x-2)^3} + \frac{80\alpha_0}{9(x-2)^3} - \frac{395d_1\alpha_0}{216(x-1)^3} + \frac{1123\alpha_0}{216(x-1)^3} - \frac{1760d_1\alpha_0}{9(x-2)^4} -$$

$$\frac{40\pi^2\alpha_0}{9(x-2)^4} + \frac{17120\alpha_0}{27(x-2)^4} - \frac{331d_1\alpha_0}{216(x-1)^4} - \frac{\pi^2\alpha_0}{18(x-1)^4} + \frac{152\alpha_0}{27(x-1)^4} - \frac{1024d_1\alpha_0}{9(x-2)^5} - \frac{80\pi^2\alpha_0}{9(x-2)^5} + \frac{19072\alpha_0}{27(x-2)^5} + \frac{205d_1\alpha_0}{216(x-1)^5} +$$

$$\frac{\pi^2\alpha_0}{18(x-1)^5} - \frac{955\alpha_0}{216(x-1)^5} + \frac{\pi^2\alpha_0}{9} - \frac{85\alpha_0}{24} - \frac{3d_1}{4} - \frac{205d_1x}{216} + \frac{\pi^2x}{18} + \frac{35x}{24} - \frac{3d_1\kappa}{4} - \frac{205d_1x\kappa}{216} + \frac{1255x\kappa}{216} + \frac{346d_1\kappa}{27(x-2)} -$$

$$\frac{952\kappa}{27(x-2)} - \frac{947d_1\kappa}{72(x-1)} + \frac{2621\kappa}{72(x-1)} - \frac{392d_1\kappa}{27(x-2)^2} + \frac{1136\kappa}{27(x-2)^2} + \frac{23d_1\kappa}{27(x-1)^2} - \frac{92\kappa}{27(x-1)^2} + \frac{784d_1\kappa}{27(x-2)^3} - \frac{2272\kappa}{27(x-2)^3} +$$

$$\frac{73d_1\kappa}{216(x-1)^3} - \frac{247\kappa}{216(x-1)^3} + \frac{256d_1\kappa}{3(x-2)^4} - \frac{3328\kappa}{9(x-2)^4} + \frac{367d_1\kappa}{216(x-1)^4} - \frac{1127\kappa}{108(x-1)^4} + \frac{512d_1\kappa}{3(x-2)^5} - \frac{2048\kappa}{3(x-2)^5} + \frac{205d_1\kappa}{216(x-1)^5} -$$

$$\frac{1255\kappa}{216(x-1)^5} + \frac{1024\kappa}{9(x-2)^6} + \frac{37\kappa}{8} + \frac{346d_1}{27(x-2)} - \frac{488}{27(x-2)} - \frac{947d_1}{72(x-1)} + \frac{443}{24(x-1)} - \frac{392d_1}{27(x-2)^2} + \frac{592}{27(x-2)^2} + \frac{23d_1}{27(x-1)^2} -$$

$$\frac{52}{27(x-1)^2} + \frac{784d_1}{27(x-2)^3} - \frac{1184}{27(x-2)^3} + \frac{73d_1}{216(x-1)^3} - \frac{83}{216(x-1)^3} + \frac{512d_1}{9(x-2)^4} + \frac{40\pi^2}{9(x-2)^4} - \frac{9536}{27(x-2)^4} + \frac{367d_1}{216(x-1)^4} +$$

$$\frac{\pi^2}{18(x-1)^4} - \frac{725}{108(x-1)^4} + \frac{512d_1}{9(x-2)^5} + \frac{160\pi^2}{9(x-2)^5} - \frac{25856}{27(x-2)^5} + \frac{205d_1}{216(x-1)^5} + \frac{\pi^2}{18(x-1)^5} - \frac{955}{216(x-1)^5} - \frac{1024d_1}{9(x-2)^6} +$$

$$\frac{160\pi^2}{9(x-2)^6} - \frac{13568}{27(x-2)^6} + \frac{55}{24}\Big) H(0;\alpha_0) + \Big(-\frac{d_1\alpha_0^5}{12} + \frac{1}{12}d_1^2x\alpha_0^5 - \frac{4}{9}d_1x\alpha_0^5 - \frac{1}{12}d_1x\kappa\alpha_0^5 - \frac{d_1\kappa\alpha_0^5}{6(x-2)} + \frac{d_1\kappa\alpha_0^5}{12(x-1)} +$$

$$\frac{d_1^2\alpha_0^5}{6(x-2)} - \frac{19d_1\alpha_0^5}{18(x-2)} - \frac{d_1^2\alpha_0^5}{12(x-1)} + \frac{4d_1\alpha_0^5}{9(x-1)} + \frac{7d_1^2\alpha_0^4}{54} - \frac{d_1\alpha_0^4}{108} - \frac{61}{108}d_1^2x\alpha_0^4 + \frac{157}{54}d_1x\alpha_0^4 - \frac{5}{27}d_1\kappa\alpha_0^4 + \frac{67}{108}d_1x\kappa\alpha_0^4 +$$

$$\frac{11d_1\kappa\alpha_0^4}{27(x-2)} - \frac{43d_1\kappa\alpha_0^4}{108(x-1)} - \frac{23d_1\kappa\alpha_0^4}{27(x-2)^2} + \frac{11d_1\kappa\alpha_0^4}{54(x-1)^2} - \frac{11d_1^2\alpha_0^4}{27(x-2)} + \frac{91d_1\alpha_0^4}{27(x-2)} + \frac{43d_1^2\alpha_0^4}{108(x-1)} - \frac{53d_1\alpha_0^4}{27(x-1)} + \frac{23d_1^2\alpha_0^4}{27(x-2)^2} -$$

$$\frac{103d_1\alpha_0^4}{27(x-2)^2} - \frac{4d_1^2\alpha_0^4}{27(x-1)^2} + \frac{37d_1\alpha_0^4}{54(x-1)^2} - \frac{8d_1^2\alpha_0^3}{9} + \frac{35d_1\alpha_0^3}{18} + \frac{95}{54}d_1^2x\alpha_0^3 - \frac{911}{108}d_1x\alpha_0^3 + \frac{4}{3}d_1\kappa\alpha_0^3 - \frac{235}{108}d_1x\kappa\alpha_0^3 +$$

$$\frac{10d_1\kappa\alpha_0^3}{27(x-2)} + \frac{16d_1\kappa\alpha_0^3}{27(x-1)} + \frac{16d_1\kappa\alpha_0^3}{27(x-2)^2} - \frac{95d_1\kappa\alpha_0^3}{108(x-1)^2} - \frac{152d_1\kappa\alpha_0^3}{27(x-2)^3} + \frac{19d_1\kappa\alpha_0^3}{36(x-1)^3} - \frac{d_1^2\alpha_0^3}{27(x-2)} - \frac{70d_1\alpha_0^3}{27(x-2)} - \frac{41d_1^2\alpha_0^3}{54(x-1)} + \frac{175d_1\alpha_0^3}{54(x-1)} -$$

$$\frac{16d_1^2\alpha_0^3}{27(x-2)^2} + \frac{176d_1\alpha_0^3}{27(x-2)^2} + \frac{17d_1^2\alpha_0^3}{27(x-1)^2} - \frac{277d_1\alpha_0^3}{108(x-1)^2} + \frac{152d_1^2\alpha_0^3}{27(x-2)^3} - \frac{472d_1\alpha_0^3}{27(x-2)^3} - \frac{d_1^2\alpha_0^3}{3(x-1)^3} + \frac{5d_1\alpha_0^3}{4(x-1)^3} + \frac{35d_1^2\alpha_0^2}{9} - \frac{85d_1\alpha_0^2}{9} -$$

$$\frac{73}{18}d_1^2x\alpha_0^2 + \frac{569}{36}d_1x\alpha_0^2 - \frac{107}{18}d_1\kappa\alpha_0^2 + \frac{205}{36}d_1x\kappa\alpha_0^2 - \frac{32d_1\kappa\alpha_0^2}{9(x-2)} + \frac{7d_1\kappa\alpha_0^2}{6(x-1)} + \frac{20d_1\kappa\alpha_0^2}{3(x-2)^2} + \frac{41d_1\kappa\alpha_0^2}{36(x-1)^2} - \frac{160d_1\kappa\alpha_0^2}{9(x-2)^3} -$$

$$\frac{31d_1\kappa\alpha_0^2}{12(x-1)^3} - \frac{208d_1\kappa\alpha_0^2}{3(x-2)^4} + \frac{37d_1\kappa\alpha_0^2}{18(x-1)^4} + \frac{8d_1^2\alpha_0^2}{9(x-2)} - \frac{32d_1\alpha_0^2}{9(x-2)} + \frac{13d_1^2\alpha_0^2}{18(x-1)} - \frac{d_1\alpha_0^2}{x-1} - \frac{10d_1^2\alpha_0^2}{3(x-2)^2} + \frac{20d_1\alpha_0^2}{3(x-2)^2} - \frac{d_1^2\alpha_0^2}{(x-1)^2} +$$

$$\frac{119d_1\alpha_0^2}{36(x-1)^2} + \frac{160d_1^2\alpha_0^2}{9(x-2)^3} - \frac{160d_1\alpha_0^2}{9(x-2)^3} + \frac{5d_1^2\alpha_0^2}{3(x-1)^3} - \frac{19d_1\alpha_0^2}{4(x-1)^3} + \frac{208d_1^2\alpha_0^2}{3(x-2)^4} - \frac{1264d_1\alpha_0^2}{9(x-2)^4} - \frac{4d_1^2\alpha_0^2}{3(x-1)^4} + \frac{7d_1\alpha_0^2}{2(x-1)^4} - \frac{80d_1^2\alpha_0}{27} +$$

$$\frac{703d_1\alpha_0}{108} + \frac{505}{108}d_1^2x\alpha_0 - \frac{1697d_1x\alpha_0}{108} + \frac{122d_1\kappa\alpha_0}{27} - \frac{187}{27}d_1x\kappa\alpha_0 + \frac{125d_1\kappa\alpha_0}{54(x-2)} - \frac{5d_1\kappa\alpha_0}{108(x-1)} - \frac{196d_1\kappa\alpha_0}{27(x-2)^2} - \frac{133d_1\kappa\alpha_0}{108(x-1)^2} +$$

$$\frac{392d_1\kappa\alpha_0}{9(x-2)^3} + \frac{43d_1\kappa\alpha_0}{12(x-1)^3} + \frac{224d_1\kappa\alpha_0}{(x-2)^4} + \frac{512d_1\kappa\alpha_0}{3(x-2)^5} - \frac{47d_1^2\alpha_0}{54(x-2)} + \frac{205d_1\alpha_0}{54(x-2)} - \frac{37d_1^2\alpha_0}{108(x-1)} + \frac{43d_1\alpha_0}{54(x-1)} + \frac{136d_1^2\alpha_0}{27(x-2)^2} -$$

$$\frac{356d_1\alpha_0}{27(x-2)^2} + \frac{19d_1^2\alpha_0}{27(x-1)^2} - \frac{263d_1\alpha_0}{108(x-1)^2} - \frac{472d_1^2\alpha_0}{9(x-2)^3} + \frac{712d_1\alpha_0}{9(x-2)^3} - \frac{7d_1^2\alpha_0}{3(x-1)^3} + \frac{23d_1\alpha_0}{4(x-1)^3} - \frac{224d_1^2\alpha_0}{(x-2)^4} + \frac{4576d_1\alpha_0}{9(x-2)^4} - \frac{512d_1^2\alpha_0}{3(x-2)^5} +$$

$$\frac{4096d_1\ \alpha_0}{9(x-2)^5}-\frac{d_1^2}{6}+\frac{13d_1}{12}-\frac{205d_1^2\ x}{108}+\frac{635d_1x}{108}+\frac{5d_1\kappa}{18}+\frac{155d_1\ x\kappa}{54}+\frac{17d_1\kappa}{27(x-2)}-\frac{151d_1\kappa}{108(x-1)}+\frac{23d_1\kappa}{27(x-2)^2}+\frac{83d_1\kappa}{108(x-1)^2}-$$

$$\frac{544d_1\kappa}{27(x-2)^3}-\frac{55d_1\kappa}{36(x-1)^3}-\frac{464d_1\kappa}{3(x-2)^4}-\frac{37d_1\kappa}{18(x-1)^4}-\frac{512d_1\kappa}{3(x-2)^5}+\frac{7d_1^2}{27\ (x-2)}+\frac{d_1}{27(x-2)}+\frac{7d_1^2}{108(x-1)}-\frac{41\ d_1}{27(x-1)}-\frac{53d_1^2}{27(x-2)^2}+$$

$$\frac{103d_1}{27\ (x-2)^2}-\frac{5d_1^2}{27(x-1)^2}+\frac{109d_1}{108\ (x-1)^2}+\frac{784d_1^2}{27(x-2)^3}-\frac{1184d_1}{27\ (x-2)^3}+\frac{d_1^2}{(x-1)^3}-\frac{9d_1}{4(x-1)^3}+\frac{464\ d_1^2}{3(x-2)^4}-\frac{368d_1}{(x-2)^4}+\frac{4d_1^2}{3\ (x-1)^4}-$$

$$\frac{7d_1}{2(x-1)^4}+\frac{512d_1^2}{3\ (x-2)^5}-\frac{4096d_1}{9(x-2)^5}\Bigg)H(1;\alpha_0)+\Bigg(\frac{x\ \alpha_0^5}{3}+x\kappa\alpha_0^5+\frac{2\kappa\alpha_0^5}{x-2}-\frac{\kappa\ \alpha_0^5}{x-1}+\frac{2\alpha_0^5}{3(x-2)}-\frac{\alpha_0^5}{3(x-1)}-\frac{19x\ \alpha_0^4}{9}-$$

$$\frac{19}{3}x\kappa\alpha_0^4-\frac{20\kappa\alpha_0^4}{3\ (x-2)}+\frac{13\kappa\alpha_0^4}{3(x-1)}+\frac{20\kappa\alpha_0^4}{3\ (x-2)^2}-\frac{4\kappa\alpha_0^4}{3(x-1)^2}+\frac{2\kappa\alpha_0^4}{3}-\frac{20\alpha_0^4}{9(x-2)}+\frac{13\alpha_0^4}{9(x-1)}+\frac{20\alpha_0^4}{9\ (x-2)^2}-\frac{4\alpha_0^4}{9(x-1)^2}+\frac{2\alpha_0^4}{9}+$$

$$\frac{52x\ \alpha_0^3}{9}+\frac{52}{3}x\kappa\alpha_0^3+\frac{20\kappa\alpha_0^3}{3\ (x-2)}-\frac{22\kappa\alpha_0^3}{3(x-1)}-\frac{40\kappa\alpha_0^3}{3\ (x-2)^2}+\frac{14\kappa\alpha_0^3}{3(x-1)^2}+\frac{80\kappa\alpha_0^3}{3\ (x-2)^3}-\frac{2\kappa\alpha_0^3}{(x-1)^3}-4\kappa\alpha_0^3+\frac{20\ \alpha_0^3}{9(x-2)}-\frac{22\alpha_0^3}{9(x-1)}-$$

$$\frac{40\alpha_0^3}{9\ (x-2)^2}+\frac{14\alpha_0^3}{9(x-1)^2}+\frac{80\alpha_0^3}{9\ (x-2)^3}-\frac{2\alpha_0^3}{3(x-1)^3}-\frac{4\alpha_0^3}{3}-\frac{28x\ \alpha_0^2}{3}-28x\kappa\alpha_0^2+\frac{6\kappa\alpha_0^2}{x-1}-\frac{6\ \kappa\alpha_0^2}{(x-1)^2}+\frac{6\kappa\alpha_0^2}{(x-1)^3}+\frac{160\ \kappa\alpha_0^2}{(x-2)^4}-$$

$$\frac{4\kappa\alpha_0^2}{(x-1)^4}+12\kappa\ \alpha_0^2+\frac{2\alpha_0^2}{x-1}-\frac{2\alpha_0^2}{(x-1)^2}+\frac{2\ \alpha_0^2}{(x-1)^3}+\frac{160\alpha_0^2}{3(x-2)^4}-\frac{4\alpha_0^2}{3\ (x-1)^4}+4\alpha_0^2+\frac{95x\alpha_0}{18}+\frac{337x\kappa\ \alpha_0}{18}+\frac{80\kappa\alpha_0}{3(x-2)}-\frac{65\kappa\alpha_0}{2\ (x-1)}-$$

$$\frac{80\kappa\alpha_0}{3(x-2)^2}+\frac{25\kappa\alpha_0}{3\ (x-1)^2}-\frac{35\kappa\alpha_0}{6(x-1)^3}-\frac{64d_1\kappa\alpha_0}{3\ (x-2)^4}-\frac{6464\kappa\alpha_0}{9(x-2)^4}-\frac{119\kappa\alpha_0}{18\ (x-1)^4}-\frac{128d_1\kappa\alpha_0}{3(x-2)^5}-\frac{7168\kappa\ \alpha_0}{9(x-2)^5}+\frac{101\kappa\alpha_0}{18(x-1)^5}+\frac{50\kappa\ \alpha_0}{9}+$$

$$\frac{80\alpha_0}{9(x-2)}-\frac{65\alpha_0}{6(x-1)}-\frac{80\alpha_0}{9\ (x-2)^2}+\frac{25\alpha_0}{9(x-1)^2}-\frac{35\alpha_0}{18(x-1)^3}-\frac{64\ d_1\alpha_0}{3(x-2)^4}-\frac{3008\alpha_0}{9(x-2)^4}-\frac{19\alpha_0}{6\ (x-1)^4}-\frac{128d_1\alpha_0}{3(x-2)^5}-\frac{4096\alpha_0}{9\ (x-2)^5}+$$

$$\frac{17\alpha_0}{6(x-1)^5}+\frac{34\ \alpha_0}{9}+\frac{x}{18}-\frac{49x\kappa}{18}+\frac{64\kappa}{3\ (x-2)}-\frac{43\kappa}{2(x-1)}-\frac{80\kappa}{3\ (x-2)^2}+\frac{8\kappa}{3(x-1)^2}+\frac{160\kappa}{3\ (x-2)^3}+\frac{\kappa}{6(x-1)^3}+\frac{64d_1\kappa}{3\ (x-2)^4}+$$

$$\frac{3584\kappa}{9(x-2)^4}+\frac{155\kappa}{18\ (x-1)^4}+\frac{256d_1\kappa}{3(x-2)^5}+\frac{8576\kappa}{9\ (x-2)^5}+\frac{101\kappa}{18(x-1)^5}+\frac{256d_1\kappa}{3\ (x-2)^6}+\frac{2816\kappa}{9(x-2)^6}-3\kappa+\frac{64}{9(x-2)}-\frac{43}{6(x-1)}-\frac{80}{9(x-2)^2}+$$

$$\frac{8}{9\ (x-1)^2}+\frac{160}{9(x-2)^3}+\frac{1}{18(x-1)^3}+\frac{64d_1}{3\ (x-2)^4}+\frac{2048}{9(x-2)^4}+\frac{23}{6(x-1)^4}+\frac{256d_1}{3\ (x-2)^5}+\frac{6272}{9(x-2)^5}+\frac{17}{6(x-1)^5}+\frac{256d_1}{3\ (x-2)^6}+$$

$$\frac{4352}{9(x-2)^6}-1\Bigg)H(0,0;\alpha_0)+\Bigg(\frac{1}{3}\ d_1x\alpha_0^5+\frac{1}{3}d_1x\kappa\alpha_0^5+\frac{2d_1\kappa\ \alpha_0^5}{3(x-2)}-\frac{d_1\kappa\alpha_0^5}{3(x-1)}+\frac{2d_1\ \alpha_0^5}{3(x-2)}-\frac{d_1\alpha_0^5}{3(x-1)}+\frac{2d_1\ \alpha_0^4}{9}-\frac{19}{9}d_1x\alpha_0^4+$$

$$\frac{2}{9}d_1\kappa\ \alpha_0^4-\frac{19}{9}d_1x\kappa\alpha_0^4-\frac{20d_1\kappa\alpha_0^4}{9\ (x-2)}+\frac{13d_1\kappa\alpha_0^4}{9(x-1)}+\frac{20d_1\kappa\ \alpha_0^4}{9(x-2)^2}-\frac{4d_1\kappa\alpha_0^4}{9(x-1)^2}-\frac{20d_1\ \alpha_0^4}{9(x-2)}+\frac{13d_1\alpha_0^4}{9(x-1)}+\frac{20d_1\alpha_0^4}{9\ (x-2)^2}-\frac{4d_1\alpha_0^4}{9(x-1)^2}-$$

$$\frac{4d_1\ \alpha_0^3}{3}+\frac{52}{9}d_1x\alpha_0^3-\frac{4}{3}d_1\kappa\ \alpha_0^3+\frac{52}{9}d_1x\kappa\alpha_0^3+\frac{20d_1\kappa\alpha_0^3}{9\ (x-2)}-\frac{22d_1\kappa\alpha_0^3}{9(x-1)}-\frac{40d_1\kappa\ \alpha_0^3}{9(x-2)^2}+\frac{14d_1\kappa\alpha_0^3}{9(x-1)^2}+\frac{80d_1\ \kappa\alpha_0^3}{9(x-2)^3}-\frac{2d_1\kappa\alpha_0^3}{3\ (x-1)^3}+$$

$$\frac{20d_1\alpha_0^3}{9(x-2)}-\frac{22d_1\alpha_0^3}{9\ (x-1)}-\frac{40d_1\alpha_0^3}{9(x-2)^2}+\frac{14d_1\alpha_0^3}{9(x-1)^2}+\frac{80d_1\alpha_0^3}{9(x-2)^3}-\frac{2d_1\alpha_0^3}{3(x-1)^3}+4d_1\ \alpha_0^2-\frac{28}{3}d_1x\alpha_0^2+4d_1\kappa\alpha_0^2-\frac{28}{3}d_1x\ \kappa\alpha_0^2+$$

$$\frac{2d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\ \alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{160d_1\ \kappa\alpha_0^2}{3(x-2)^4}-\frac{4d_1\kappa\alpha_0^2}{3\ (x-1)^4}+\frac{2d_1\alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{2\ d_1\alpha_0^2}{(x-1)^3}+\frac{160d_1\alpha_0^2}{3(x-2)^4}-\frac{4d_1\ \alpha_0^2}{3(x-1)^4}+\frac{34d_1\alpha_0}{9}+$$

$$\frac{95d_1x\ \alpha_0}{18}+\frac{8d_1\kappa\alpha_0}{9}+\frac{121}{18}d_1x\kappa\ \alpha_0+\frac{80d_1\kappa\alpha_0}{9(x-2)}-\frac{65d_1\kappa\alpha_0}{6\ (x-1)}-\frac{80d_1\kappa\alpha_0}{9(x-2)^2}+\frac{25d_1\kappa\ \alpha_0}{9(x-1)^2}-\frac{35d_1\kappa\alpha_0}{18(x-1)^3}-\frac{192d_1\ \kappa\alpha_0}{(x-2)^4}-\frac{31d_1\kappa\alpha_0}{18(x-1)^4}-$$

$$\frac{512\ d_1\kappa\alpha_0}{3(x-2)^5}+\frac{25d_1\kappa\alpha_0}{18\ (x-1)^5}+\frac{80d_1\alpha_0}{9(x-2)}-\frac{65d_1\alpha_0}{6\ (x-1)}-\frac{80d_1\alpha_0}{9(x-2)^2}+\frac{25d_1\alpha_0}{9\ (x-1)^2}-\frac{35d_1\alpha_0}{18(x-1)^3}-\frac{64d_1^2\alpha_0}{3\ (x-2)^4}-\frac{3008d_1\alpha_0}{9(x-2)^4}-\frac{19d_1\alpha_0}{6(x-1)^4}-$$

$$\frac{128d_1^2\alpha_0}{3(x-2)^5}-\frac{4096d_1\alpha_0}{9\ (x-2)^5}+\frac{17d_1\alpha_0}{6(x-1)^5}-d_1+\frac{d_1x}{18}-d_1\kappa-\frac{25d_1x\kappa}{18}+\frac{64d_1\kappa}{9(x-2)}-\frac{43\ d_1\kappa}{6(x-1)}-\frac{80d_1\kappa}{9(x-2)^2}+\frac{8d_1\ \kappa}{9(x-1)^2}+\frac{160d_1\kappa}{9(x-2)^3}+$$

$$\frac{d_1\ \kappa}{18(x-1)^3}+\frac{256d_1\kappa}{3(x-2)^4}+\frac{43d_1\ \kappa}{18(x-1)^4}+\frac{128d_1\kappa}{(x-2)^5}+\frac{25d_1\ \kappa}{18(x-1)^5}-\frac{256d_1\kappa}{3(x-2)^6}+\frac{64\ d_1}{9(x-2)}-\frac{43d_1}{6(x-1)}-\frac{80d_1}{9(x-2)^2}+\frac{8\ d_1}{9(x-1)^2}+\frac{160d_1}{9(x-2)^3}+$$

$$\frac{d_1}{18\ (x-1)^3}+\frac{64d_1^2}{3(x-2)^4}+\frac{2048d_1}{9\ (x-2)^4}+\frac{23d_1}{6(x-1)^4}+\frac{256d_1^2}{3\ (x-2)^5}+\frac{6272d_1}{9(x-2)^5}+\frac{17d_1}{6\ (x-1)^5}+\frac{256d_1^2}{3(x-2)^6}+\frac{4352d_1}{9(x-2)^6}\Bigg)\ H(0,1;\alpha_0)+$$

$$H(1;x)\Bigg(\frac{1}{18}\pi^2x\alpha_0+\frac{1}{6}\pi^2x\ \kappa\alpha_0+\frac{40\pi^2\kappa\alpha_0}{3(x-2)^4}+\frac{d_1\pi^2\ \kappa\alpha_0}{9(x-1)^4}-\frac{\pi^2\kappa\alpha_0}{6(x-1)^4}+\frac{80\ \pi^2\kappa\alpha_0}{3(x-2)^5}-\frac{d_1\pi^2\kappa\alpha_0}{9\ (x-1)^5}+\frac{\pi^2\kappa\alpha_0}{6(x-1)^5}-\frac{1}{3}\pi^2\ \kappa\alpha_0+$$

$$\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{d_1\pi^2\alpha_0}{9\ (x-1)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{80\pi^2\alpha_0}{9\ (x-2)^5}-\frac{d_1\pi^2\alpha_0}{9(x-1)^5}+\frac{\pi^2\alpha_0}{18\ (x-1)^5}-\frac{\pi^2\alpha_0}{9}-\frac{\pi^2x}{18}-\frac{1}{6}\pi^2\ x\kappa-\frac{40\pi^2\kappa}{3(x-2)^4}-\frac{d_1\pi^2\kappa}{9(x-1)^4}+$$

$$\frac{\pi^2\kappa}{6(x-1)^4}-\frac{160\pi^2\kappa}{3(x-2)^5}-\frac{d_1\pi^2\kappa}{9(x-1)^5}+\frac{\pi^2\kappa}{6(x-1)^5}-\frac{160\pi^2\kappa}{3(x-2)^6}+\Bigg(-\frac{2d_1\ \alpha_0}{3}+\frac{17x\alpha_0}{12}-\frac{2d_1\kappa\alpha_0}{3}+\frac{101x\ \kappa\alpha_0}{36}-\frac{85d_1\kappa\alpha_0}{9(x-2)}+$$

$$\frac{40\kappa\ \alpha_0}{3(x-2)}+\frac{94d_1\kappa\alpha_0}{9(x-1)}-\frac{65\kappa\ \alpha_0}{4(x-1)}+\frac{100d_1\kappa\alpha_0}{9(x-2)^2}-\frac{40\kappa\ \alpha_0}{3(x-2)^2}-\frac{20d_1\kappa\alpha_0}{9(x-1)^2}+\frac{25\kappa\ \alpha_0}{6(x-1)^2}-\frac{40d_1\kappa\alpha_0}{3(x-2)^3}+\frac{17d_1\ \kappa\alpha_0}{18(x-1)^3}-\frac{35\kappa\alpha_0}{12(x-1)^3}+$$

$$\frac{64\ d_1\kappa\alpha_0}{(x-2)^4}-\frac{1088\kappa\alpha_0}{9(x-2)^4}+\frac{19\ d_1\kappa\alpha_0}{18(x-1)^4}-\frac{47\kappa\alpha_0}{36\ (x-1)^4}+\frac{64d_1\kappa\alpha_0}{3(x-2)^5}+\frac{704\kappa\ \alpha_0}{9(x-2)^5}-\frac{25d_1\kappa\alpha_0}{18(x-1)^5}+\frac{101\ \kappa\alpha_0}{36(x-1)^5}-\frac{37\kappa\alpha_0}{9}-\frac{85d_1\alpha_0}{9\ (x-2)}+$$

$$\frac{40\alpha_0}{9(x-2)}+\frac{94d_1\alpha_0}{9(x-1)}-\frac{65\ \alpha_0}{12(x-1)}+\frac{100d_1\alpha_0}{9(x-2)^2}-\frac{40\alpha_0}{9\ (x-2)^2}-\frac{20d_1\alpha_0}{9(x-1)^2}+\frac{25\alpha_0}{18\ (x-1)^2}-\frac{40d_1\alpha_0}{3(x-2)^3}+\frac{17d_1\alpha_0}{18\ (x-1)^3}-\frac{35\alpha_0}{36(x-1)^3}+$$

$$\frac{64d_1\ \alpha_0}{(x-2)^4}+\frac{64\alpha_0}{9(x-2)^4}+\frac{5d_1\alpha_0}{2\ (x-1)^4}-\frac{11\alpha_0}{12(x-1)^4}+\frac{64d_1\alpha_0}{3\ (x-2)^5}+\frac{1088\alpha_0}{9(x-2)^5}-\frac{17d_1\alpha_0}{6\ (x-1)^5}+\frac{17\alpha_0}{12(x-1)^5}-\frac{7\alpha_0}{3}+\frac{2\ d_1}{3}-\frac{17x}{12}+$$

$$\frac{2d_1\kappa}{3}-\frac{101x\kappa}{36}-\frac{62d_1\kappa}{9(x-2)}+\frac{32\kappa}{3\ (x-2)}+\frac{65d_1\kappa}{9(x-1)}-\frac{43\kappa}{4\ (x-1)}+\frac{70d_1\kappa}{9(x-2)^2}-\frac{40\kappa}{3(x-2)^2}-\frac{d_1\kappa}{(x-1)^2}+\frac{4\kappa}{3(x-1)^2}-\frac{80d_1\ \kappa}{9(x-2)^3}+$$

$$\frac{80\kappa}{3(x-2)^3}+\frac{5d_1\kappa}{18(x-1)^3}+\frac{\kappa}{12(x-1)^3}-\frac{112d_1\kappa}{3\ (x-2)^4}+\frac{1088\kappa}{9(x-2)^4}-\frac{31d_1\kappa}{18\ (x-1)^4}+\frac{155\kappa}{36(x-1)^4}-\frac{448d_1\kappa}{3\ (x-2)^5}+\frac{1472\kappa}{9(x-2)^5}-\frac{25d_1\kappa}{18\ (x-1)^5}+$$

$$\frac{101\kappa}{36(x-1)^5}-\frac{128d_1\kappa}{3\ (x-2)^6}-\frac{1408\kappa}{9(x-2)^6}-\frac{3\kappa}{2}-\frac{62\ d_1}{9(x-2)}+\frac{32}{9(x-2)}+\frac{65d_1}{9(x-1)}-\frac{43}{12\ (x-1)}+\frac{70d_1}{9(x-2)^2}-\frac{40}{9\ (x-2)^2}-\frac{d_1}{(x-1)^2}+$$

$$\frac{4}{9(x-1)^2}-\frac{80d_1}{9\ (x-2)^3}+\frac{80}{9(x-2)^3}+\frac{5d_1}{18(x-1)^3}+\frac{1}{36\ (x-1)^3}-\frac{112d_1}{3(x-2)^4}-\frac{64}{9(x-2)^4}-\frac{19\ d_1}{6(x-1)^4}+\frac{23}{12(x-1)^4}-\frac{448d_1}{3\ (x-2)^5}-$$

$$\frac{1216}{9(x-2)^5}-\frac{17d_1}{6(x-1)^5}+\frac{17}{12\ (x-1)^5}-\frac{128d_1}{3(x-2)^6}-\frac{2176}{9(x-2)^6}-\frac{1}{2}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{2x\alpha_0}{3}-2x\kappa\alpha_0-\frac{160\ \kappa\alpha_0}{(x-2)^4}-\frac{4d_1\kappa\alpha_0}{3(x-1)^4}+$$
$$\frac{2\ \kappa\alpha_0}{(x-1)^4}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{4d_1\ \kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\alpha_0}{(x-1)^5}+4\kappa\ \alpha_0-\frac{160\alpha_0}{3(x-2)^4}-\frac{4d_1\alpha_0}{3(x-1)^4}+\frac{2\ \alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{4d_1\alpha_0}{3\ (x-1)^5}-\frac{2\alpha_0}{3(x-1)^5}+$$
$$\frac{4\alpha_0}{3}+\frac{2x}{3}+2x\ \kappa+\frac{160\kappa}{(x-2)^4}+\frac{4d_1\kappa}{3\ (x-1)^4}-\frac{2\kappa}{(x-1)^4}+\frac{640\kappa}{(x-2)^5}+\frac{4d_1\kappa}{3(x-1)^5}-\frac{2\kappa}{(x-1)^5}+\frac{640\kappa}{(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{4d_1}{3\ (x-1)^4}-$$
$$\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}+\frac{4d_1}{3\ (x-1)^5}-\frac{2}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Bigg)\ H(0,0;\alpha_0)+\Bigg(-\frac{4\alpha_0d_1^2}{3(x-1)^4}+\frac{4d_1^2}{3\ (x-1)^4}+\frac{4\alpha_0d_1^2}{3(x-1)^5}+\frac{4d_1^2}{3\ (x-1)^5}+$$
$$\frac{4\alpha_0d_1}{3}-\frac{2\alpha_0xd_1}{3}+\frac{2xd_1}{3}+\frac{4\alpha_0\kappa d_1}{3}-\frac{2}{3}\alpha_0x\kappa d_1+\frac{2x\ \kappa d_1}{3}-\frac{160\alpha_0\kappa d_1}{3(x-2)^4}+\frac{160\ \kappa d_1}{3(x-2)^4}+\frac{2\alpha_0\kappa d_1}{3(x-1)^4}-\frac{2\ \kappa d_1}{3(x-1)^4}-\frac{320\alpha_0\kappa d_1}{3\ (x-2)^5}+$$
$$\frac{640\kappa d_1}{3(x-2)^5}-\frac{2\alpha_0\kappa d_1}{3\ (x-1)^5}-\frac{2\kappa d_1}{3(x-1)^5}+\frac{640\kappa d_1}{3\ (x-2)^6}-\frac{160\alpha_0d_1}{3(x-2)^4}+\frac{160d_1}{3\ (x-2)^4}+\frac{2\alpha_0d_1}{3(x-1)^4}-\frac{2d_1}{3\ (x-1)^4}-\frac{320\alpha_0d_1}{3(x-2)^5}+\frac{640d_1}{3\ (x-2)^5}-$$
$$\frac{2\alpha_0d_1}{3(x-1)^5}-\frac{2d_1}{3\ (x-1)^5}+\frac{640d_1}{3(x-2)^6}\Bigg)H(0,1;\alpha_0)-\frac{40\pi^2}{9\ (x-2)^4}-\frac{d_1\pi^2}{9(x-1)^4}+\frac{\pi^2}{18\ (x-1)^4}-\frac{160\pi^2}{9(x-2)^5}-\frac{d_1\pi^2}{9\ (x-1)^5}+\frac{\pi^2}{18(x-1)^5}-$$
$$\frac{160\pi^2}{9(x-2)^6}\Bigg)+\ \Bigg(-\frac{4d_1\alpha_0}{3}+\frac{2d_1x\alpha_0}{3}-\frac{2x\ \alpha_0}{3}-\frac{4d_1\kappa\alpha_0}{3}+\frac{2}{3}d_1x\kappa\alpha_0-2x\ \kappa\alpha_0+\frac{160d_1\kappa\alpha_0}{3(x-2)^4}-\frac{160\kappa\ \alpha_0}{(x-2)^4}-\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+$$
$$\frac{2\kappa\ \alpha_0}{(x-1)^4}+\frac{320d_1\kappa\alpha_0}{3(x-2)^5}-\frac{320\kappa\ \alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\ \alpha_0}{(x-1)^5}+4\kappa\alpha_0+\frac{160d_1\alpha_0}{3(x-2)^4}-\frac{160\ \alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3\ (x-1)^4}+\frac{320d_1\alpha_0}{3(x-2)^5}-$$
$$\frac{320\alpha_0}{3\ (x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\ \alpha_0}{3}-\frac{2d_1x}{3}+\frac{2x}{3}-\frac{2d_1x\kappa}{3}+2x\ \kappa-\frac{160d_1\kappa}{3(x-2)^4}+\frac{160\kappa}{(x-2)^4}+\frac{2d_1\kappa}{3(x-1)^4}-\frac{2\kappa}{(x-1)^4}-$$
$$\frac{640d_1\kappa}{3(x-2)^5}+\frac{640\kappa}{(x-2)^5}+\frac{2\ d_1\kappa}{3(x-1)^5}-\frac{2\kappa}{(x-1)^5}-\frac{640d_1\ \kappa}{3(x-2)^6}+\frac{640\kappa}{(x-2)^6}-\frac{160d_1}{3\ (x-2)^4}+\frac{160}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{2}{3\ (x-1)^4}-\frac{640d_1}{3(x-2)^5}+$$
$$\frac{640}{3(x-2)^5}+\frac{2\ d_1}{3(x-1)^5}-\frac{2}{3(x-1)^5}-\frac{640d_1}{3\ (x-2)^6}+\frac{640}{3(x-2)^6}\Bigg)H(0;\alpha_0)H(0,1;x)+\Bigg(\frac{17x\ \alpha_0}{12}+\frac{101x\kappa\alpha_0}{36}+\frac{40\kappa\alpha_0}{3(x-2)}-$$
$$\frac{65\kappa\alpha_0}{4(x-1)}-\frac{40\kappa\alpha_0}{3\ (x-2)^2}+\frac{25\kappa\alpha_0}{6(x-1)^2}-\frac{35\kappa\alpha_0}{12\ (x-1)^3}+\frac{32d_1\kappa\alpha_0}{3(x-2)^4}-\frac{1088\kappa\ \alpha_0}{9(x-2)^4}-\frac{47\kappa\alpha_0}{36(x-1)^4}+\frac{64d_1\kappa\ \alpha_0}{3(x-2)^5}+\frac{704\kappa\alpha_0}{9(x-2)^5}+\frac{101\kappa\ \alpha_0}{36(x-1)^5}-$$
$$\frac{37\kappa\alpha_0}{9}+\frac{40\alpha_0}{9\ (x-2)}-\frac{65\alpha_0}{12(x-1)}-\frac{40\alpha_0}{9(x-2)^2}+\frac{25\ \alpha_0}{18(x-1)^2}-\frac{35\alpha_0}{36(x-1)^3}+\frac{32d_1\alpha_0}{3\ (x-2)^4}+\frac{64\alpha_0}{9(x-2)^4}-\frac{11\alpha_0}{12(x-1)^4}+\frac{64\ d_1\alpha_0}{3(x-2)^5}+$$
$$\frac{1088\alpha_0}{9(x-2)^5}+\frac{17\alpha_0}{12\ (x-1)^5}-\frac{7\alpha_0}{3}-\frac{17x}{12}-\frac{101x\kappa}{36}+\frac{32\kappa}{3(x-2)}-\frac{43\kappa}{4(x-1)}-\frac{40\ \kappa}{3(x-2)^2}+\frac{4\kappa}{3(x-1)^2}+\frac{80\kappa}{3\ (x-2)^3}+\frac{\kappa}{12(x-1)^3}-$$
$$\frac{32d_1\kappa}{3(x-2)^4}+\frac{1088\kappa}{9(x-2)^4}+\frac{155\kappa}{36\ (x-1)^4}-\frac{128d_1\kappa}{3(x-2)^5}+\frac{1472\kappa}{9\ (x-2)^5}+\frac{101\kappa}{36(x-1)^5}-\frac{128d_1\kappa}{3\ (x-2)^6}-\frac{1408\kappa}{9(x-2)^6}-\frac{3\kappa}{2}+\Bigg(-\frac{2x\alpha_0}{3}-2x\kappa\alpha_0-$$
$$\frac{160\kappa\ \alpha_0}{(x-2)^4}+\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{320\kappa\ \alpha_0}{(x-2)^5}-\frac{2\kappa\alpha_0}{(x-1)^5}+4\kappa\alpha_0-\frac{160\ \alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3\ (x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+2x\ \kappa+$$
$$\frac{160\kappa}{(x-2)^4}-\frac{2\kappa}{(x-1)^4}+\frac{640\kappa}{(x-2)^5}-\frac{2\kappa}{(x-1)^5}+\frac{640\kappa}{(x-2)^6}+\frac{160}{3\ (x-2)^4}-\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}-\frac{2}{3\ (x-1)^5}+\frac{640}{3(x-2)^6}\Bigg)H(0;\alpha_0)+$$
$$\Bigg(\frac{4\alpha_0\ d_1}{3}-\frac{2\alpha_0xd_1}{3}+\frac{2xd_1}{3}+\frac{4\alpha_0\kappa\ d_1}{3}-\frac{2}{3}\alpha_0x\kappa d_1+\frac{2x\kappa\ d_1}{3}-\frac{160\alpha_0\kappa d_1}{3(x-2)^4}+\frac{160\kappa\ d_1}{3(x-2)^4}+\frac{2\alpha_0\kappa d_1}{3(x-1)^4}-\frac{2\kappa\ d_1}{3(x-1)^4}-\frac{320\alpha_0\kappa d_1}{3(x-2)^5}+$$
$$\frac{640\ \kappa d_1}{3(x-2)^5}-\frac{2\alpha_0\kappa d_1}{3(x-1)^5}-\frac{2\ \kappa d_1}{3(x-1)^5}+\frac{640\kappa d_1}{3(x-2)^6}-\frac{160\ \alpha_0d_1}{3(x-2)^4}+\frac{160d_1}{3(x-2)^4}+\frac{2\alpha_0d_1}{3\ (x-1)^4}-\frac{2d_1}{3(x-1)^4}-\frac{320\alpha_0d_1}{3\ (x-2)^5}+\frac{640d_1}{3(x-2)^5}-$$
$$\frac{2\alpha_0d_1}{3\ (x-1)^5}-\frac{2d_1}{3(x-1)^5}+\frac{640d_1}{3(x-2)^6}\Bigg)\ H(1;\alpha_0)+\frac{32}{9(x-2)}-\frac{43}{12(x-1)}-\frac{40}{9(x-2)^2}+\frac{4}{9(x-1)^2}+\frac{80}{9(x-2)^3}+\frac{1}{36\ (x-1)^3}-$$
$$\frac{32d_1}{3(x-2)^4}-\frac{64}{9(x-2)^4}+\frac{23}{12\ (x-1)^4}-\frac{128d_1}{3(x-2)^5}-\frac{1216}{9\ (x-2)^5}+\frac{17}{12(x-1)^5}-\frac{128d_1}{3\ (x-2)^6}-\frac{2176}{9(x-2)^6}-\frac{1}{2}\Bigg)\ H(0,c_1(\alpha_0);x)+$$
$$\Bigg(-\frac{64d_1\kappa\alpha_0}{3(x-2)^4}-\frac{704\ \kappa\alpha_0}{9(x-2)^4}-\frac{128d_1\kappa\alpha_0}{3\ (x-2)^5}-\frac{1408\kappa\alpha_0}{9(x-2)^5}-\frac{64d_1\alpha_0}{3\ (x-2)^4}-\frac{1088\alpha_0}{9(x-2)^4}-\frac{128d_1\alpha_0}{3\ (x-2)^5}-\frac{2176\alpha_0}{9(x-2)^5}+\frac{64d_1\kappa}{3(x-2)^4}+\frac{704\kappa}{9(x-2)^4}+$$
$$\frac{256d_1\kappa}{3\ (x-2)^5}+\frac{2816\kappa}{9(x-2)^5}+\frac{256d_1\kappa}{3\ (x-2)^6}+\frac{2816\kappa}{9(x-2)^6}+\Bigg(\frac{320\kappa\ \alpha_0}{(x-2)^4}+\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320\alpha_0}{3\ (x-2)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{320\kappa}{(x-2)^4}-\frac{1280\kappa}{(x-2)^5}-\frac{1280\kappa}{(x-2)^6}-$$
$$\frac{320}{3(x-2)^4}-\frac{1280}{3(x-2)^5}-\frac{1280}{3\ (x-2)^6}\Bigg)H(0;\alpha_0)+\Bigg(\frac{320\alpha_0\kappa d_1}{3\ (x-2)^4}-\frac{320\kappa d_1}{3(x-2)^4}+\frac{640\alpha_0\kappa\ d_1}{3(x-2)^5}-\frac{1280\kappa d_1}{3(x-2)^5}-\frac{1280\kappa\ d_1}{3(x-2)^6}+\frac{320\alpha_0d_1}{3(x-2)^4}-$$
$$\frac{320d_1}{3\ (x-2)^4}+\frac{640\alpha_0d_1}{3(x-2)^5}-\frac{1280d_1}{3\ (x-2)^5}-\frac{1280d_1}{3(x-2)^6}\Bigg)H(1;\alpha_0)+\frac{64d_1}{3\ (x-2)^4}+\frac{1088}{9(x-2)^4}+\frac{256d_1}{3\ (x-2)^5}+\frac{4352}{9(x-2)^5}+\frac{256d_1}{3\ (x-2)^6}+$$
$$\frac{4352}{9(x-2)^6}\Bigg)H(0,c_2(\alpha_0);x)+\Bigg(\frac{1}{3}\ d_1x\alpha_0^5+\frac{1}{3}d_1x\kappa\alpha_0^5+\frac{2d_1\kappa\ \alpha_0^5}{3(x-2)}-\frac{d_1\kappa\alpha_0^5}{3(x-1)}+\frac{2d_1\ \alpha_0^5}{3(x-2)}-\frac{d_1\alpha_0^5}{3(x-1)}+\frac{2d_1\ \alpha_0^4}{9}-\frac{19}{9}d_1x\alpha_0^4+$$
$$\frac{2}{9}d_1\kappa\ \alpha_0^4-\frac{19}{9}d_1x\kappa\alpha_0^4-\frac{20d_1\kappa\alpha_0^4}{9\ (x-2)}+\frac{13d_1\kappa\alpha_0^4}{9(x-1)}+\frac{20d_1\kappa\ \alpha_0^4}{9(x-2)^2}-\frac{4d_1\kappa\alpha_0^4}{9(x-1)^2}-\frac{20d_1\ \alpha_0^4}{9(x-2)}+\frac{13d_1\alpha_0^4}{9(x-1)}+\frac{20d_1\alpha_0^4}{9\ (x-2)^2}-\frac{4d_1\alpha_0^4}{9(x-1)^2}-$$
$$\frac{4d_1\ \alpha_0^3}{3}+\frac{52}{9}d_1x\alpha_0^3-\frac{4}{3}d_1\kappa\ \alpha_0^3+\frac{52}{9}d_1x\kappa\alpha_0^3+\frac{20d_1\kappa\alpha_0^3}{9\ (x-2)}-\frac{22d_1\kappa\alpha_0^3}{9(x-1)}-\frac{40d_1\kappa\ \alpha_0^3}{9(x-2)^2}+\frac{14d_1\kappa\alpha_0^3}{9(x-1)^2}+\frac{80d_1\ \kappa\alpha_0^3}{9(x-2)^3}-\frac{2d_1\kappa\alpha_0^3}{3\ (x-1)^3}+$$
$$\frac{20d_1\alpha_0^3}{9(x-2)}-\frac{22d_1\alpha_0^3}{9\ (x-1)}-\frac{40d_1\alpha_0^3}{9(x-2)^2}+\frac{14d_1\alpha_0^3}{9(x-1)^2}+\frac{80d_1\alpha_0^3}{9(x-2)^3}-\frac{2d_1\alpha_0^3}{3(x-1)^3}+4d_1\ \alpha_0^2-\frac{28}{3}d_1x\alpha_0^2+4d_1\kappa\alpha_0^2-\frac{28}{3}d_1x\ \kappa\alpha_0^2+$$
$$\frac{2d_1\kappa\alpha_0^2}{x-1}-\frac{2d_1\kappa\ \alpha_0^2}{(x-1)^2}+\frac{2d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{160d_1\ \kappa\alpha_0^2}{3(x-2)^4}-\frac{4d_1\kappa\alpha_0^2}{3\ (x-1)^4}+\frac{2d_1\alpha_0^2}{x-1}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{2\ d_1\alpha_0^2}{(x-1)^3}+\frac{160d_1\alpha_0^2}{3(x-2)^4}-\frac{4d_1\ \alpha_0^2}{3(x-1)^4}-\frac{20d_1\alpha_0}{9}+$$
$$\frac{73d_1x\ \alpha_0}{9}-\frac{20d_1\kappa\alpha_0}{9}+\frac{73}{9}d_1x\kappa\ \alpha_0-\frac{10d_1\kappa\alpha_0}{9(x-2)}-\frac{7d_1\kappa\alpha_0}{9\ (x-1)}+\frac{40d_1\kappa\alpha_0}{9(x-2)^2}+\frac{10d_1\kappa\ \alpha_0}{9(x-1)^2}-\frac{80d_1\kappa\alpha_0}{3(x-2)^3}-\frac{2d_1\ \kappa\alpha_0}{(x-1)^3}-\frac{640d_1\kappa\alpha_0}{3(x-2)^4}-$$
$$\frac{640\ d_1\kappa\alpha_0}{3(x-2)^5}-\frac{10d_1\alpha_0}{9(x-2)}-\frac{7d_1\ \alpha_0}{9(x-1)}+\frac{40d_1\alpha_0}{9(x-2)^2}+\frac{10d_1\alpha_0}{9\ (x-1)^2}-\frac{80d_1\alpha_0}{3(x-2)^3}-\frac{2d_1\ \alpha_0}{(x-1)^3}-\frac{640d_1\alpha_0}{3(x-2)^4}-\frac{640d_1\alpha_0}{3\ (x-2)^5}-\frac{2d_1}{3}-\frac{25d_1x}{9}-$$

$$\frac{2d_1\kappa}{3} - \frac{25 d_1 x\kappa}{9} + \frac{4d_1\kappa}{9(x-2)} + \frac{d_1\kappa}{9(x-1)} - \frac{20d_1\kappa}{9(x-2)^2} - \frac{2d_1\kappa}{9(x-1)^2} + \frac{160d_1\kappa}{9(x-2)^3} + \frac{2d_1\kappa}{3(x-1)^3} + \frac{160 d_1\kappa}{(x-2)^4} + \frac{4d_1\kappa}{3(x-1)^4} + \frac{640 d_1\kappa}{3(x-2)^5} +$$

$$\frac{4d_1}{9(x-2)} + \frac{d_1}{9(x-1)} - \frac{20d_1}{9(x-2)^2} - \frac{2d_1}{9(x-1)^2} + \frac{160d_1}{9(x-2)^3} + \frac{2d_1}{3(x-1)^3} + \frac{160d_1}{(x-2)^4} + \frac{4d_1}{3(x-1)^4} + \frac{640d_1}{3(x-2)^5}\Big) H(1,0;\alpha_0) +$$

$$\Big(\frac{2d_1\alpha_0}{3} - \frac{17x\alpha_0}{12} + \frac{2d_1\kappa\alpha_0}{3} - \frac{101 x\kappa\alpha_0}{36} + \frac{85 d_1\kappa\alpha_0}{9(x-2)} - \frac{40\kappa\alpha_0}{3(x-2)} - \frac{94 d_1\kappa\alpha_0}{9(x-1)} + \frac{65\kappa\alpha_0}{4(x-1)} - \frac{100 d_1\kappa\alpha_0}{9(x-2)^2} + \frac{40\kappa\alpha_0}{3(x-2)^2} + \frac{20 d_1\kappa\alpha_0}{9(x-1)^2} -$$

$$\frac{25\kappa\alpha_0}{6(x-1)^2} + \frac{40 d_1\kappa\alpha_0}{3(x-2)^3} - \frac{17 d_1\kappa\alpha_0}{18(x-1)^3} + \frac{35\kappa\alpha_0}{12(x-1)^3} - \frac{64 d_1\kappa\alpha_0}{(x-2)^4} + \frac{1088\kappa\alpha_0}{9(x-2)^4} - \frac{19 d_1\kappa\alpha_0}{18(x-1)^4} + \frac{47\kappa\alpha_0}{36(x-1)^4} - \frac{64 d_1\kappa\alpha_0}{3(x-2)^5} - \frac{704\kappa\alpha_0}{9(x-2)^5} +$$

$$\frac{25 d_1\kappa\alpha_0}{18(x-1)^5} - \frac{101\kappa\alpha_0}{36(x-1)^5} + \frac{37\kappa\alpha_0}{9} + \frac{85 d_1\alpha_0}{9(x-2)} - \frac{40\alpha_0}{9(x-2)} - \frac{94 d_1\alpha_0}{9(x-1)} + \frac{65\alpha_0}{12(x-1)} - \frac{100 d_1\alpha_0}{9(x-2)^2} + \frac{40\alpha_0}{9(x-2)^2} + \frac{20 d_1\alpha_0}{9(x-1)^2} -$$

$$\frac{25\alpha_0}{18(x-1)^2} + \frac{40 d_1\alpha_0}{3(x-2)^3} - \frac{17 d_1\alpha_0}{18(x-1)^3} + \frac{35\alpha_0}{36(x-1)^3} - \frac{64 d_1\alpha_0}{(x-2)^4} - \frac{64\alpha_0}{9(x-2)^4} - \frac{5 d_1\alpha_0}{2(x-1)^4} + \frac{11\alpha_0}{12(x-1)^4} - \frac{64 d_1\alpha_0}{3(x-2)^5} - \frac{1088\alpha_0}{9(x-2)^5} +$$

$$\frac{17 d_1\alpha_0}{6(x-1)^5} - \frac{17\alpha_0}{12(x-1)^5} + \frac{7\alpha_0}{3} - \frac{2d_1}{3} + \frac{17x}{12} - \frac{2d_1\kappa}{3} + \frac{101x\kappa}{36} + \frac{62 d_1\kappa}{9(x-2)} - \frac{32\kappa}{3(x-2)} - \frac{65 d_1\kappa}{9(x-1)} + \frac{43\kappa}{4(x-1)} - \frac{70 d_1\kappa}{9(x-2)^2} +$$

$$\frac{40\kappa}{3(x-2)^2} + \frac{d_1\kappa}{(x-1)^2} - \frac{4\kappa}{3(x-1)^2} + \frac{80 d_1\kappa}{9(x-2)^3} - \frac{80\kappa}{3(x-2)^3} - \frac{5d_1\kappa}{18(x-1)^3} - \frac{\kappa}{12(x-1)^3} + \frac{112 d_1\kappa}{3(x-2)^4} - \frac{1088\kappa}{9(x-2)^4} + \frac{31 d_1\kappa}{18(x-1)^4} -$$

$$\frac{155\kappa}{36(x-1)^4} + \frac{448 d_1\kappa}{3(x-2)^5} - \frac{1472\kappa}{9(x-2)^5} + \frac{25 d_1\kappa}{18(x-1)^5} - \frac{101\kappa}{36(x-1)^5} + \frac{128 d_1\kappa}{3(x-2)^6} + \frac{1408\kappa}{9(x-2)^6} + \frac{3\kappa}{2} + \frac{62 d_1}{9(x-2)} - \frac{32}{9(x-2)} - \frac{65 d_1}{9(x-1)} +$$

$$\frac{43}{12(x-1)} - \frac{70 d_1}{9(x-2)^2} + \frac{40}{9(x-2)^2} + \frac{d_1}{(x-1)^2} - \frac{4}{9(x-1)^2} + \frac{80 d_1}{9(x-2)^3} - \frac{80}{9(x-2)^3} - \frac{5d_1}{18(x-1)^3} - \frac{1}{36(x-1)^3} + \frac{112 d_1}{3(x-2)^4} +$$

$$\frac{64}{9(x-2)^4} + \frac{19 d_1}{6(x-1)^4} - \frac{23}{12(x-1)^4} + \frac{448 d_1}{3(x-2)^5} + \frac{1216}{9(x-2)^5} + \frac{17 d_1}{6(x-1)^5} - \frac{17}{12(x-1)^5} + \frac{128 d_1}{3(x-2)^6} + \frac{2176}{9(x-2)^6} + \frac12 \Big) H(1,0;x) +$$

$$\Big(\frac13 d_1^2 x\alpha_0^5 + \frac{2d_1^2\alpha_0^5}{3(x-2)} - \frac{d_1^2\alpha_0^5}{3(x-1)} + \frac{2d_1^2\alpha_0^4}{9} - \frac{19}{9} d_1^2 x\alpha_0^4 - \frac{20 d_1^2\alpha_0^4}{9(x-2)} + \frac{13 d_1^2\alpha_0^4}{9(x-1)} + \frac{20 d_1^2\alpha_0^4}{9(x-2)^2} - \frac{4d_1^2\alpha_0^4}{9(x-1)^2} - \frac{4d_1^2\alpha_0^3}{3} +$$

$$\frac{52}{9} d_1^2 x\alpha_0^3 + \frac{20 d_1^2\alpha_0^3}{9(x-2)} - \frac{22 d_1^2\alpha_0^3}{9(x-1)} - \frac{40 d_1^2\alpha_0^3}{9(x-2)^2} + \frac{14 d_1^2\alpha_0^3}{9(x-1)^2} + \frac{80 d_1^2\alpha_0^3}{9(x-2)^3} - \frac{2d_1^2\alpha_0^3}{3(x-1)^3} + 4d_1^2\alpha_0^2 - \frac{28}{3} d_1^2 x\alpha_0^2 + \frac{2d_1^2\alpha_0^2}{x-1} - \frac{2d_1^2\alpha_0^2}{(x-1)^2} +$$

$$\frac{2d_1^2\alpha_0^2}{(x-1)^3} + \frac{160 d_1^2\alpha_0^2}{3(x-2)^4} - \frac{4d_1^2\alpha_0^2}{3(x-1)^4} - \frac{20 d_1^2\alpha_0}{9} + \frac{73}{9} d_1^2 x\alpha_0 - \frac{10 d_1^2\alpha_0}{9(x-2)} - \frac{7 d_1^2\alpha_0}{9(x-1)} + \frac{40 d_1^2\alpha_0}{9(x-2)^2} + \frac{10 d_1^2\alpha_0}{9(x-1)^2} - \frac{80 d_1^2\alpha_0}{3(x-2)^3} - \frac{2d_1^2\alpha_0}{(x-1)^3} -$$

$$\frac{640 d_1^2\alpha_0}{3(x-2)^4} - \frac{640 d_1^2\alpha_0}{3(x-2)^5} - \frac{2d_1^2}{3} - \frac{25 d_1^2 x}{9} + \frac{4d_1^2}{9(x-2)} + \frac{d_1^2}{9(x-1)} - \frac{20 d_1^2}{9(x-2)^2} - \frac{2d_1^2}{9(x-1)^2} + \frac{160 d_1^2}{9(x-2)^3} + \frac{2d_1^2}{3(x-1)^3} + \frac{160 d_1^2}{(x-2)^4} +$$

$$\frac{4d_1^2}{3(x-1)^4} + \frac{640 d_1^2}{3(x-2)^5}\Big) H(1,1;\alpha_0) + H(c_2(\alpha_0);x)\Big(-\frac{256\kappa\alpha_0}{9(x-2)^4} - \frac{512\kappa\alpha_0}{9(x-2)^5} + \frac{256 d_1\alpha_0}{9(x-2)^4} - \frac{40\pi^2\alpha_0}{9(x-2)^4} + \frac{3392\alpha_0}{27(x-2)^4} +$$

$$\frac{512 d_1\alpha_0}{9(x-2)^5} - \frac{80\pi^2\alpha_0}{9(x-2)^5} + \frac{6784\alpha_0}{27(x-2)^5} + \frac{256\kappa}{9(x-2)^4} + \frac{1024\kappa}{9(x-2)^5} + \frac{1024\kappa}{9(x-2)^6} + \Big(-\frac{64 d_1\kappa\alpha_0}{3(x-2)^4} - \frac{704\kappa\alpha_0}{9(x-2)^4} - \frac{128 d_1\kappa\alpha_0}{3(x-2)^5} -$$

$$\frac{1408\kappa\alpha_0}{9(x-2)^5} - \frac{64 d_1\alpha_0}{3(x-2)^4} - \frac{1088\alpha_0}{9(x-2)^4} - \frac{128 d_1\alpha_0}{3(x-2)^5} - \frac{2176\alpha_0}{9(x-2)^5} + \frac{64 d_1\kappa}{3(x-2)^4} + \frac{704\kappa}{9(x-2)^4} + \frac{256 d_1\kappa}{3(x-2)^5} + \frac{2816\kappa}{9(x-2)^5} + \frac{256 d_1\kappa}{3(x-2)^6} +$$

$$\frac{2816\kappa}{9(x-2)^6} + \frac{64 d_1}{3(x-2)^4} + \frac{1088}{9(x-2)^4} + \frac{256 d_1}{3(x-2)^5} + \frac{4352}{9(x-2)^5} + \frac{256 d_1}{3(x-2)^6} + \frac{4352}{9(x-2)^6}\Big) H(0;\alpha_0) + \Big(-\frac{64\alpha_0 d_1^2}{3(x-2)^4} + \frac{64 d_1^2}{3(x-2)^4} -$$

$$\frac{128\alpha_0 d_1^2}{3(x-2)^5} + \frac{256 d_1^2}{3(x-2)^5} + \frac{256 d_1^2}{3(x-2)^6} + \frac{64\alpha_0\kappa d_1}{3(x-2)^4} - \frac{64\kappa d_1}{3(x-2)^4} + \frac{128\alpha_0\kappa d_1}{3(x-2)^5} - \frac{256\kappa d_1}{3(x-2)^5} - \frac{256\kappa d_1}{3(x-2)^6} - \frac{1088\alpha_0 d_1}{9(x-2)^4} + \frac{1088 d_1}{9(x-2)^4} -$$

$$\frac{2176\alpha_0 d_1}{9(x-2)^5} + \frac{4352 d_1}{9(x-2)^5} + \frac{4352 d_1}{9(x-2)^6}\Big) H(1;\alpha_0) + \Big(\frac{320\kappa\alpha_0}{(x-2)^4} + \frac{640\kappa\alpha_0}{(x-2)^5} + \frac{320\alpha_0}{3(x-2)^4} + \frac{640\alpha_0}{3(x-2)^5} - \frac{320\kappa}{(x-2)^4} - \frac{1280\kappa}{(x-2)^5} -$$

$$\frac{1280\kappa}{(x-2)^6} - \frac{320}{3(x-2)^4} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big(\frac{320\alpha_0\kappa d_1}{3(x-2)^4} - \frac{320\kappa d_1}{3(x-2)^4} + \frac{640\alpha_0\kappa d_1}{3(x-2)^5} - \frac{1280\kappa d_1}{3(x-2)^5} - \frac{1280\kappa d_1}{3(x-2)^6} +$$

$$\frac{320\alpha_0 d_1}{3(x-2)^4} - \frac{320 d_1}{3(x-2)^4} + \frac{640\alpha_0 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^6}\Big) H(0,1;\alpha_0) + \Big(\frac{320\alpha_0\kappa d_1}{3(x-2)^4} - \frac{320\kappa d_1}{3(x-2)^4} + \frac{640\alpha_0\kappa d_1}{3(x-2)^5} -$$

$$\frac{1280\kappa d_1}{3(x-2)^5} - \frac{1280\kappa d_1}{3(x-2)^6} + \frac{320\alpha_0 d_1}{3(x-2)^4} - \frac{320 d_1}{3(x-2)^4} + \frac{640\alpha_0 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^5} - \frac{1280 d_1}{3(x-2)^6}\Big) H(1,0;\alpha_0) + \Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4} - \frac{320 d_1^2}{3(x-2)^4} +$$

$$\frac{640\alpha_0 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^6}\Big) H(1,1;\alpha_0) - \frac{256 d_1}{9(x-2)^4} + \frac{40\pi^2}{9(x-2)^4} - \frac{3392}{27(x-2)^4} - \frac{1024 d_1}{9(x-2)^5} + \frac{160\pi^2}{9(x-2)^5} - \frac{13568}{27(x-2)^5} -$$

$$\frac{1024 d_1}{9(x-2)^6} + \frac{160\pi^2}{9(x-2)^6} - \frac{13568}{27(x-2)^6}\Big) + H(c_1(\alpha_0);x)\Big(\frac{1}{24} d_1 x\alpha_0^5 - \frac{2x\alpha_0^5}{9} + \frac{1}{24} d_1 x\kappa\alpha_0^5 - \frac{11}{36} x\kappa\alpha_0^5 + \frac{d_1\kappa\alpha_0^5}{12(x-2)} -$$

$$\frac{25\kappa\alpha_0^5}{36(x-2)} - \frac{d_1\kappa\alpha_0^5}{24(x-1)} + \frac{11\kappa\alpha_0^5}{36(x-1)} - \frac{\kappa\alpha_0^5}{24} + \frac{d_1\alpha_0^5}{12(x-2)} - \frac{19\alpha_0^5}{36(x-2)} - \frac{d_1\alpha_0^5}{24(x-1)} + \frac{2\alpha_0^5}{9(x-1)} - \frac{\alpha_0^5}{24} + \frac{7 d_1\alpha_0^4}{108} - \frac{61}{216} d_1 x\alpha_0^4 +$$

$$\frac{157 x\alpha_0^4}{108} + \frac{7}{108} d_1\kappa\alpha_0^4 - \frac{61}{216} d_1 x\kappa\alpha_0^4 + \frac{56}{27} x\kappa\alpha_0^4 - \frac{11 d_1\kappa\alpha_0^4}{54(x-2)} + \frac{113\kappa\alpha_0^4}{54(x-2)} + \frac{43 d_1\kappa\alpha_0^4}{216(x-1)} - \frac{149\kappa\alpha_0^4}{108(x-1)} + \frac{23 d_1\kappa\alpha_0^4}{54(x-2)^2} -$$

$$\frac{149\kappa\alpha_0^4}{54(x-2)^2} - \frac{2d_1\kappa\alpha_0^4}{27(x-1)^2} + \frac{59\kappa\alpha_0^4}{108(x-1)^2} - \frac{41\kappa\alpha_0^4}{216} - \frac{11 d_1\alpha_0^4}{54(x-2)} + \frac{91\alpha_0^4}{54(x-2)} + \frac{43 d_1\alpha_0^4}{216(x-1)} - \frac{53\alpha_0^4}{54(x-1)} + \frac{23 d_1\alpha_0^4}{54(x-2)^2} - \frac{103\alpha_0^4}{54(x-2)^2} -$$

$$\frac{2d_1\alpha_0^4}{27(x-1)^2} + \frac{37\alpha_0^4}{108(x-1)^2} - \frac{\alpha_0^4}{216} - \frac{4d_1\alpha_0^3}{9} + \frac{95}{108} d_1 x\alpha_0^3 - \frac{911 x\alpha_0^3}{216} - \frac49 d_1\kappa\alpha_0^3 + \frac{95}{108} d_1 x\kappa\alpha_0^3 - \frac{1381}{216} x\kappa\alpha_0^3 - \frac{d_1\kappa\alpha_0^3}{54(x-2)} -$$

$$\frac{25\kappa\alpha_0^3}{27(x-2)} - \frac{41 d_1\kappa\alpha_0^3}{108(x-1)} + \frac{239\kappa\alpha_0^3}{108(x-1)} - \frac{8 d_1\kappa\alpha_0^3}{27(x-2)^2} + \frac{104\kappa\alpha_0^3}{27(x-2)^2} + \frac{17 d_1\kappa\alpha_0^3}{54(x-1)^2} - \frac{467\kappa\alpha_0^3}{216(x-1)^2} + \frac{76 d_1\kappa\alpha_0^3}{27(x-2)^3} - \frac{388\kappa\alpha_0^3}{27(x-2)^3} - \frac{d_1\kappa\alpha_0^3}{6(x-1)^3} +$$

$$\frac{83\kappa\alpha_0^3}{72(x-1)^3} + \frac{83\kappa\alpha_0^3}{36} - \frac{d_1\alpha_0^3}{54(x-2)} - \frac{35\alpha_0^3}{27(x-2)} - \frac{41 d_1\alpha_0^3}{108(x-1)} + \frac{175\alpha_0^3}{108(x-1)} - \frac{8 d_1\alpha_0^3}{27(x-2)^2} + \frac{88\alpha_0^3}{27(x-2)^2} + \frac{17 d_1\alpha_0^3}{54(x-1)^2} - \frac{277\alpha_0^3}{216(x-1)^2} +$$

$$\frac{76 d_1\alpha_0^3}{27(x-2)^3} - \frac{236\alpha_0^3}{27(x-2)^3} - \frac{d_1\alpha_0^3}{6(x-1)^3} + \frac{5\alpha_0^3}{8(x-1)^3} + \frac{35\alpha_0^3}{36} + \frac{35 d_1\alpha_0^2}{18} - \frac{73}{36} d_1 x\alpha_0^2 + \frac{569 x\alpha_0^2}{72} + \frac{35}{18} d_1\kappa\alpha_0^2 - \frac{73}{36} d_1 x\kappa\alpha_0^2 +$$

$$\frac{979}{72}x\kappa\alpha_0^2+\frac{4d_1\kappa\alpha_0^2}{9(x-2)}-\frac{16\kappa\alpha_0^2}{3(x-2)}+\frac{13d_1\kappa\alpha_0^2}{36(x-1)}+\frac{2\kappa\alpha_0^2}{3(x-1)}-\frac{5d_1\kappa\alpha_0^2}{3(x-2)^2}+\frac{10\kappa\alpha_0^2}{(x-2)^2}-\frac{d_1\kappa\alpha_0^2}{2(x-1)^2}+\frac{67\kappa\alpha_0^2}{24(x-1)^2}+\frac{80d_1\kappa\alpha_0^2}{9(x-2)^3}-$$
$$\frac{80\kappa\alpha_0^2}{3(x-2)^3}+\frac{5d_1\kappa\alpha_0^2}{6(x-1)^3}-\frac{119\kappa\alpha_0^2}{24(x-1)^3}+\frac{104d_1\kappa\alpha_0^2}{3(x-2)^4}-\frac{1256\kappa\alpha_0^2}{9(x-2)^4}-\frac{2d_1\kappa\alpha_0^2}{3(x-1)^4}+\frac{137\kappa\alpha_0^2}{36(x-1)^4}-\frac{32\kappa\alpha_0^2}{3}+\frac{4d_1\alpha_0^2}{9(x-2)}-\frac{16\alpha_0^2}{9(x-2)}+$$
$$\frac{13d_1\alpha_0^2}{36(x-1)}-\frac{\alpha_0^2}{2(x-1)}-\frac{5d_1\alpha_0^2}{3(x-2)^2}+\frac{10\alpha_0^2}{3(x-2)^2}-\frac{d_1\alpha_0^2}{2(x-1)^2}+\frac{119\alpha_0^2}{72(x-1)^2}+\frac{80d_1\alpha_0^2}{9(x-2)^3}-\frac{80\alpha_0^2}{9(x-2)^3}+\frac{5d_1\alpha_0^2}{6(x-1)^3}-\frac{19\alpha_0^2}{8(x-1)^3}+$$
$$\frac{104d_1\alpha_0^2}{3(x-2)^4}-\frac{632\alpha_0^2}{9(x-2)^4}-\frac{2d_1\alpha_0^2}{3(x-1)^4}+\frac{7\alpha_0^2}{4(x-1)^4}-\frac{85\alpha_0^2}{18}-\frac{22d_1\alpha_0}{27}+\frac{505d_1x\alpha_0}{216}-\frac{1697x\alpha_0}{216}-\frac{22d_1\kappa\alpha_0}{27}+\frac{505}{216}d_1x\kappa\alpha_0-$$
$$\frac{3193x\kappa\alpha_0}{216}+\frac{386d_1\kappa\alpha_0}{27(x-2)}-\frac{1172\kappa\alpha_0}{27(x-2)}-\frac{1133d_1\kappa\alpha_0}{72(x-1)}+\frac{3811\kappa\alpha_0}{72(x-1)}-\frac{362d_1\kappa\alpha_0}{27(x-2)^2}+\frac{1136\kappa\alpha_0}{27(x-2)^2}+\frac{193d_1\kappa\alpha_0}{108(x-1)^2}-\frac{1273\kappa\alpha_0}{108(x-1)^2}-$$
$$\frac{80d_1\kappa\alpha_0}{9(x-2)^3}+\frac{40\kappa\alpha_0}{3(x-2)^3}-\frac{323d_1\kappa\alpha_0}{216(x-1)^3}+\frac{2075\kappa\alpha_0}{216(x-1)^3}-\frac{464d_1\kappa\alpha_0}{3(x-2)^4}+\frac{2032\kappa\alpha_0}{3(x-2)^4}-\frac{187d_1\kappa\alpha_0}{216(x-1)^4}+\frac{539\kappa\alpha_0}{108(x-1)^4}-\frac{256d_1\kappa\alpha_0}{3(x-2)^5}+$$
$$\frac{3584\kappa\alpha_0}{9(x-2)^5}+\frac{205d_1\kappa\alpha_0}{216(x-1)^5}-\frac{1255\kappa\alpha_0}{216(x-1)^5}+\frac{857\kappa\alpha_0}{216}+\frac{386d_1\alpha_0}{27(x-2)}-\frac{604\alpha_0}{27(x-2)}-\frac{1133d_1\alpha_0}{72(x-1)}+\frac{649\alpha_0}{24(x-1)}-\frac{362d_1\alpha_0}{27(x-2)^2}+\frac{592\alpha_0}{27(x-2)^2}+$$
$$\frac{193d_1\alpha_0}{108(x-1)^2}-\frac{671\alpha_0}{108(x-1)^2}-\frac{80d_1\alpha_0}{9(x-2)^3}+\frac{40\alpha_0}{9(x-2)^3}-\frac{323d_1\alpha_0}{216(x-1)^3}+\frac{1015\alpha_0}{216(x-1)^3}-\frac{464d_1\alpha_0}{3(x-2)^4}+\frac{368\alpha_0}{(x-2)^4}-\frac{187d_1\alpha_0}{216(x-1)^4}-$$
$$\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{419\alpha_0}{108(x-1)^4}-\frac{256d_1\alpha_0}{3(x-2)^5}+\frac{2048\alpha_0}{9(x-2)^5}+\frac{205d_1\alpha_0}{216(x-1)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-\frac{955\alpha_0}{216(x-1)^5}+\frac{325\alpha_0}{216}-\frac{3d_1}{4}-\frac{205d_1x}{216}+$$
$$\frac{635x}{216}-\frac{3d_1\kappa}{4}-\frac{205d_1x\kappa}{216}+\frac{1255x\kappa}{216}+\frac{346d_1\kappa}{27(x-2)}-\frac{952\kappa}{27(x-2)}-\frac{947d_1\kappa}{72(x-1)}+\frac{2621\kappa}{72(x-1)}-\frac{392d_1\kappa}{27(x-2)^2}+\frac{1136\kappa}{27(x-2)^2}+\frac{23d_1\kappa}{27(x-1)^2}-$$
$$\frac{92\kappa}{27(x-1)^2}+\frac{784d_1\kappa}{27(x-2)^3}-\frac{2272\kappa}{27(x-2)^3}+\frac{73d_1\kappa}{216(x-1)^3}-\frac{247\kappa}{216(x-1)^3}+\frac{256d_1\kappa}{3(x-2)^4}-\frac{3584\kappa}{9(x-2)^4}+\frac{367d_1\kappa}{216(x-1)^4}-\frac{1127\kappa}{108(x-1)^4}+$$
$$\frac{512d_1\kappa}{3(x-2)^5}-\frac{7168\kappa}{9(x-2)^5}+\frac{205d_1\kappa}{216(x-1)^5}-\frac{1255\kappa}{216(x-1)^5}+\frac{37\kappa}{8}+\Bigg(\frac{x\alpha_0^5}{6}+\frac{1}{2}x\kappa\alpha_0^5+\frac{\kappa\alpha_0^5}{x-2}-\frac{\kappa\alpha_0^5}{2(x-1)}+\frac{\alpha_0^5}{3(x-2)}-\frac{\alpha_0^5}{6(x-1)}-$$
$$\frac{19x\alpha_0^4}{18}-\frac{19}{6}x\kappa\alpha_0^4-\frac{10\kappa\alpha_0^4}{3(x-2)}+\frac{13\kappa\alpha_0^4}{6(x-1)}+\frac{10\kappa\alpha_0^4}{3(x-2)^2}-\frac{2\kappa\alpha_0^4}{3(x-1)^2}+\frac{\kappa\alpha_0^4}{3}-\frac{10\alpha_0^4}{9(x-2)}+\frac{13\alpha_0^4}{18(x-1)}+\frac{10\alpha_0^4}{9(x-2)^2}-\frac{2\alpha_0^4}{9(x-1)^2}+$$
$$\frac{\alpha_0^4}{9}+\frac{26x\alpha_0^3}{9}+\frac{26}{3}x\kappa\alpha_0^3+\frac{10\kappa\alpha_0^3}{3(x-2)}-\frac{11\kappa\alpha_0^3}{3(x-1)}-\frac{20\kappa\alpha_0^3}{3(x-2)^2}+\frac{7\kappa\alpha_0^3}{3(x-1)^2}+\frac{40\kappa\alpha_0^3}{3(x-2)^3}-\frac{\kappa\alpha_0^3}{(x-1)^3}-2\kappa\alpha_0^3+\frac{10\alpha_0^3}{9(x-2)}-\frac{11\alpha_0^3}{9(x-1)}-$$
$$\frac{20\alpha_0^3}{9(x-2)^2}+\frac{7\alpha_0^3}{9(x-1)^2}+\frac{40\alpha_0^3}{9(x-2)^3}-\frac{\alpha_0^3}{3(x-1)^3}-\frac{2\alpha_0^3}{3}-\frac{14x\alpha_0^2}{3}-14x\kappa\alpha_0^2+\frac{3\kappa\alpha_0^2}{x-1}-\frac{3\kappa\alpha_0^2}{(x-1)^2}+\frac{3\kappa\alpha_0^2}{(x-1)^3}+\frac{80\kappa\alpha_0^2}{(x-2)^4}-\frac{2\kappa\alpha_0^2}{(x-1)^4}+$$
$$6\kappa\alpha_0^2+\frac{\alpha_0^2}{x-1}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}+\frac{80\alpha_0^2}{3(x-2)^4}-\frac{2\alpha_0^2}{3(x-1)^4}+2\alpha_0^2+\frac{73x\alpha_0}{18}+\frac{73x\kappa\alpha_0}{6}+\frac{80\kappa\alpha_0}{3(x-2)}-\frac{65\kappa\alpha_0}{2(x-1)}-\frac{80\kappa\alpha_0}{3(x-2)^2}+$$
$$\frac{25\kappa\alpha_0}{3(x-1)^2}-\frac{35\kappa\alpha_0}{6(x-1)^3}-\frac{480\kappa\alpha_0}{(x-2)^4}-\frac{83\kappa\alpha_0}{18(x-1)^4}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{101\kappa\alpha_0}{18(x-1)^5}-\frac{4\kappa\alpha_0}{3}+\frac{80\alpha_0}{9(x-2)}-\frac{65\alpha_0}{6(x-1)}-\frac{80\alpha_0}{9(x-2)^2}+\frac{25\alpha_0}{9(x-1)^2}-$$
$$\frac{35\alpha_0}{18(x-1)^3}-\frac{160\alpha_0}{(x-2)^4}-\frac{5\alpha_0}{2(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{17\alpha_0}{6(x-1)^5}-\frac{4\alpha_0}{9}-\frac{25x}{18}-\frac{25x\kappa}{6}+\frac{64\kappa}{3(x-2)}-\frac{43\kappa}{2(x-1)}-\frac{80\kappa}{3(x-2)^2}+\frac{8\kappa}{3(x-1)^2}+$$
$$\frac{160\kappa}{3(x-2)^3}+\frac{\kappa}{6(x-1)^3}+\frac{320\kappa}{(x-2)^4}+\frac{155\kappa}{18(x-1)^4}+\frac{640\kappa}{(x-2)^5}+\frac{101\kappa}{18(x-1)^5}-3\kappa+\frac{64}{9(x-2)}-\frac{43}{6(x-1)}-\frac{80}{9(x-2)^2}+\frac{8}{9(x-1)^2}+$$
$$\frac{160}{9(x-2)^3}+\frac{1}{18(x-1)^3}+\frac{320}{3(x-2)^4}+\frac{23}{6(x-1)^4}+\frac{640}{3(x-2)^5}+\frac{17}{6(x-1)^5}-1\Bigg)H(0;\alpha_0)+\Bigg(\frac{1}{6}d_1x\alpha_0^5+\frac{1}{6}d_1x\kappa\alpha_0^5+\frac{d_1\kappa\alpha_0^5}{3(x-2)}-$$
$$\frac{d_1\kappa\alpha_0^5}{6(x-1)}+\frac{d_1\alpha_0^5}{3(x-2)}-\frac{d_1\alpha_0^5}{6(x-1)}+\frac{d_1\alpha_0^4}{9}-\frac{19}{18}d_1x\alpha_0^4+\frac{1}{9}d_1\kappa\alpha_0^4-\frac{19}{18}d_1x\kappa\alpha_0^4-\frac{10d_1\kappa\alpha_0^4}{9(x-2)}+\frac{13d_1\kappa\alpha_0^4}{18(x-1)}+\frac{10d_1\kappa\alpha_0^4}{9(x-2)^2}-$$
$$\frac{2d_1\kappa\alpha_0^4}{9(x-1)^2}-\frac{10d_1\alpha_0^4}{9(x-2)}+\frac{13d_1\alpha_0^4}{18(x-1)}+\frac{10d_1\alpha_0^4}{9(x-2)^2}-\frac{2d_1\alpha_0^4}{9(x-1)^2}-\frac{2d_1\alpha_0^3}{3}+\frac{26}{9}d_1x\alpha_0^3-\frac{2}{3}d_1\kappa\alpha_0^3+\frac{26}{9}d_1x\kappa\alpha_0^3+\frac{10d_1\kappa\alpha_0^3}{9(x-2)}-$$
$$\frac{11d_1\kappa\alpha_0^3}{9(x-1)}-\frac{20d_1\kappa\alpha_0^3}{9(x-2)^2}+\frac{7d_1\kappa\alpha_0^3}{9(x-1)^2}+\frac{40d_1\kappa\alpha_0^3}{9(x-2)^3}-\frac{d_1\kappa\alpha_0^3}{3(x-1)^3}+\frac{10d_1\alpha_0^3}{9(x-2)}-\frac{11d_1\alpha_0^3}{9(x-1)}-\frac{20d_1\alpha_0^3}{9(x-2)^2}+\frac{7d_1\alpha_0^3}{9(x-1)^2}+\frac{40d_1\alpha_0^3}{9(x-2)^3}-$$
$$\frac{d_1\alpha_0^3}{3(x-1)^3}+2d_1\alpha_0^2-\frac{14}{3}d_1x\alpha_0^2+2d_1\kappa\alpha_0^2-\frac{14}{3}d_1x\kappa\alpha_0^2+\frac{d_1\kappa\alpha_0^2}{x-1}-\frac{d_1\kappa\alpha_0^2}{(x-1)^2}+\frac{d_1\kappa\alpha_0^2}{(x-1)^3}+\frac{80d_1\kappa\alpha_0^2}{3(x-2)^4}-\frac{2d_1\kappa\alpha_0^2}{3(x-1)^4}+$$
$$\frac{d_1\alpha_0^2}{x-1}-\frac{d_1\alpha_0^2}{(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}+\frac{80d_1\alpha_0^2}{3(x-2)^4}-\frac{2d_1\alpha_0^2}{3(x-1)^4}-\frac{4d_1\alpha_0}{9}+\frac{73d_1x\alpha_0}{18}-\frac{4d_1\kappa\alpha_0}{9}+\frac{73}{18}d_1x\kappa\alpha_0+\frac{80d_1\kappa\alpha_0}{9(x-2)}-\frac{65d_1\kappa\alpha_0}{6(x-1)}-$$
$$\frac{80d_1\kappa\alpha_0}{9(x-2)^2}+\frac{25d_1\kappa\alpha_0}{9(x-1)^2}-\frac{35d_1\kappa\alpha_0}{18(x-1)^3}-\frac{160d_1\kappa\alpha_0}{(x-2)^4}-\frac{19d_1\kappa\alpha_0}{18(x-1)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{25d_1\kappa\alpha_0}{18(x-1)^5}+\frac{80d_1\alpha_0}{9(x-2)}-\frac{65d_1\alpha_0}{6(x-1)}-\frac{80d_1\alpha_0}{9(x-2)^2}+$$
$$\frac{25d_1\alpha_0}{9(x-1)^2}-\frac{35d_1\alpha_0}{18(x-1)^3}-\frac{160d_1\alpha_0}{(x-2)^4}-\frac{5d_1\alpha_0}{2(x-1)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{17d_1\alpha_0}{6(x-1)^5}-d_1-\frac{25d_1x}{18}-d_1\kappa-\frac{25d_1x\kappa}{18}+\frac{64d_1\kappa}{9(x-2)}-$$
$$\frac{43d_1\kappa}{6(x-1)}-\frac{80d_1\kappa}{9(x-2)^2}+\frac{8d_1\kappa}{9(x-1)^2}+\frac{160d_1\kappa}{9(x-2)^3}+\frac{d_1\kappa}{18(x-1)^3}+\frac{320d_1\kappa}{3(x-2)^4}+\frac{43d_1\kappa}{18(x-1)^4}+\frac{640d_1\kappa}{3(x-2)^5}+\frac{25d_1\kappa}{18(x-1)^5}+\frac{64d_1}{9(x-2)}-$$
$$\frac{43d_1}{6(x-1)}-\frac{80d_1}{9(x-2)^2}+\frac{8d_1}{9(x-1)^2}+\frac{160d_1}{9(x-2)^3}+\frac{d_1}{18(x-1)^3}+\frac{320d_1}{3(x-2)^4}+\frac{23d_1}{6(x-1)^4}+\frac{640d_1}{3(x-2)^5}+\frac{17d_1}{6(x-1)^5}\Bigg)H(1;\alpha_0)+$$
$$\Bigg(\frac{4\kappa\alpha_0}{(x-1)^4}-\frac{4\kappa\alpha_0}{(x-1)^5}+\frac{4\alpha_0}{3(x-1)^4}-\frac{4\alpha_0}{3(x-1)^5}-\frac{4\kappa}{(x-1)^4}-\frac{4\kappa}{(x-1)^5}-\frac{4}{3(x-1)^4}-\frac{4}{3(x-1)^5}\Bigg)H(0,0;\alpha_0)+\Bigg(\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-$$
$$\frac{4\kappa d_1}{3(x-1)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}+\frac{4\alpha_0 d_1}{3(x-1)^4}-\frac{4d_1}{3(x-1)^4}-\frac{4\alpha_0 d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}\Bigg)H(0,1;\alpha_0)+\Bigg(\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}-$$
$$\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}+\frac{4\alpha_0 d_1}{3(x-1)^4}-\frac{4d_1}{3(x-1)^4}-\frac{4\alpha_0 d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}\Bigg)H(1,0;\alpha_0)+\Bigg(\frac{4\alpha_0 d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}-\frac{4\alpha_0 d_1^2}{3(x-1)^5}-$$
$$\frac{4d_1^2}{3(x-1)^5}\Bigg)H(1,1;\alpha_0)+\frac{346d_1}{27(x-2)}-\frac{488}{27(x-2)}-\frac{947d_1}{72(x-1)}+\frac{443}{24(x-1)}-\frac{392d_1}{27(x-2)^2}+\frac{592}{27(x-2)^2}+\frac{23d_1}{27(x-1)^2}-$$
$$\frac{52}{27(x-1)^2}+\frac{784d_1}{27(x-2)^3}-\frac{1184}{27(x-2)^3}+\frac{73d_1}{216(x-1)^3}-\frac{83}{216(x-1)^3}+\frac{256d_1}{3(x-2)^4}-\frac{2048}{9(x-2)^4}+\frac{367d_1}{216(x-1)^4}+\frac{\pi^2}{18(x-1)^4}-$$

$$\frac{725}{108(x-1)^4}+\frac{512d_1}{3(x-2)^5}-\frac{4096}{9(x-2)^5}+\frac{205d_1}{216(x-1)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{955}{216(x-1)^5}+\frac{55}{24}\Big)+\Big(\frac{4\alpha_0 d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}-\frac{4\alpha_0 d_1^2}{3(x-1)^5}-$$

$$\frac{4d_1^2}{3(x-1)^5}-\frac{4\alpha_0 d_1}{3}+\frac{2\alpha_0 x d_1}{3}-\frac{2xd_1}{3}-\frac{4\alpha_0\kappa d_1}{3}+\frac{2}{3}\alpha_0 x\kappa d_1-\frac{2x\kappa d_1}{3}+\frac{160\alpha_0\kappa d_1}{3(x-2)^4}-\frac{160\kappa d_1}{3(x-2)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^4}+\frac{4\kappa d_1}{3(x-1)^4}+$$

$$\frac{320\alpha_0\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^5}+\frac{4\alpha_0\kappa d_1}{3(x-1)^5}+\frac{4\kappa d_1}{3(x-1)^5}-\frac{640\kappa d_1}{3(x-2)^6}+\frac{160\alpha_0 d_1}{3(x-2)^4}-\frac{160 d_1}{3(x-2)^4}-\frac{4\alpha_0 d_1}{3(x-1)^4}+\frac{4d_1}{3(x-1)^4}+\frac{320\alpha_0 d_1}{3(x-2)^5}-$$

$$\frac{640d_1}{3(x-2)^5}+\frac{4\alpha_0 d_1}{3(x-1)^5}+\frac{4d_1}{3(x-1)^5}-\frac{640d_1}{3(x-2)^6}+\frac{2\alpha_0}{3}-\frac{\alpha_0 x}{3}+\frac{x}{3}+2\alpha_0\kappa-\alpha_0 x\kappa+x\kappa-\frac{80\alpha_0\kappa}{(x-2)^4}+\frac{80\kappa}{(x-2)^4}+\frac{\alpha_0\kappa}{(x-1)^4}-$$

$$\frac{\kappa}{(x-1)^4}-\frac{160\alpha_0\kappa}{(x-2)^5}+\frac{320\kappa}{(x-2)^5}-\frac{\alpha_0\kappa}{(x-1)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}-\frac{80\alpha_0}{3(x-2)^4}+\frac{80}{3(x-2)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{1}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+$$

$$\frac{320}{3(x-2)^5}-\frac{\alpha_0}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(0;\alpha_0)H(1,1;x)+\Big(-\frac{2d_1\alpha_0}{3}+\frac{17x\alpha_0}{12}-\frac{2d_1\kappa\alpha_0}{3}+\frac{101x\kappa\alpha_0}{36}-$$

$$\frac{85d_1\kappa\alpha_0}{9(x-2)}+\frac{40\kappa\alpha_0}{3(x-2)}+\frac{94d_1\kappa\alpha_0}{9(x-1)}-\frac{65\kappa\alpha_0}{4(x-1)}+\frac{100d_1\kappa\alpha_0}{9(x-2)^2}-\frac{40\kappa\alpha_0}{3(x-2)^2}-\frac{20d_1\kappa\alpha_0}{9(x-1)^2}+\frac{25\kappa\alpha_0}{6(x-1)^2}-\frac{40d_1\kappa\alpha_0}{3(x-2)^3}+\frac{17d_1\kappa\alpha_0}{18(x-1)^3}-$$

$$\frac{35\kappa\alpha_0}{12(x-1)^3}+\frac{64d_1\kappa\alpha_0}{(x-2)^4}-\frac{1088\kappa\alpha_0}{9(x-2)^4}+\frac{19d_1\kappa\alpha_0}{18(x-1)^4}-\frac{47\kappa\alpha_0}{36(x-1)^4}+\frac{64d_1\kappa\alpha_0}{3(x-2)^5}+\frac{704\kappa\alpha_0}{9(x-2)^5}-\frac{25d_1\kappa\alpha_0}{18(x-1)^5}+\frac{101\kappa\alpha_0}{36(x-1)^5}-\frac{37\kappa\alpha_0}{9}-$$

$$\frac{85d_1\alpha_0}{9(x-2)}+\frac{40\alpha_0}{9(x-2)}+\frac{94d_1\alpha_0}{9(x-1)}-\frac{65\alpha_0}{12(x-1)}+\frac{100d_1\alpha_0}{9(x-2)^2}-\frac{40\alpha_0}{9(x-2)^2}-\frac{20d_1\alpha_0}{9(x-1)^2}+\frac{25\alpha_0}{18(x-1)^2}-\frac{40d_1\alpha_0}{3(x-2)^3}+\frac{17d_1\alpha_0}{18(x-1)^3}-$$

$$\frac{35\alpha_0}{36(x-1)^3}+\frac{64d_1\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{9(x-2)^4}+\frac{5d_1\alpha_0}{2(x-1)^4}-\frac{11\alpha_0}{12(x-1)^4}+\frac{64d_1\alpha_0}{3(x-2)^5}+\frac{1088\alpha_0}{9(x-2)^5}-\frac{17d_1\alpha_0}{6(x-1)^5}+\frac{17\alpha_0}{12(x-1)^5}-\frac{7\alpha_0}{3}+\frac{2d_1}{3}-$$

$$\frac{17x}{12}+\frac{2d_1\kappa}{3}-\frac{101x\kappa}{36}-\frac{62d_1\kappa}{9(x-2)}+\frac{32\kappa}{3(x-2)}+\frac{65d_1\kappa}{9(x-1)}-\frac{43\kappa}{4(x-1)}+\frac{70d_1\kappa}{9(x-2)^2}-\frac{40\kappa}{3(x-2)^2}-\frac{d_1\kappa}{(x-1)^2}+\frac{4\kappa}{3(x-1)^2}-\frac{80d_1\kappa}{9(x-2)^3}+$$

$$\frac{80\kappa}{3(x-2)^3}+\frac{5d_1\kappa}{18(x-1)^3}+\frac{\kappa}{12(x-1)^3}-\frac{112d_1\kappa}{3(x-2)^4}+\frac{1088\kappa}{9(x-2)^4}-\frac{31d_1\kappa}{18(x-1)^4}+\frac{155\kappa}{36(x-1)^4}-\frac{448d_1\kappa}{3(x-2)^5}+\frac{1472\kappa}{9(x-2)^5}-\frac{25d_1\kappa}{18(x-1)^5}+$$

$$\frac{101\kappa}{36(x-1)^5}-\frac{128d_1\kappa}{3(x-2)^6}-\frac{1408\kappa}{9(x-2)^6}-\frac{3\kappa}{2}+\Big(-\frac{2x\alpha_0}{3}-2x\kappa\alpha_0-\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{4d_1\kappa\alpha_0}{3(x-1)^4}+\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{4d_1\kappa\alpha_0}{3(x-1)^5}-$$

$$\frac{2\kappa\alpha_0}{(x-1)^5}+4\kappa\alpha_0-\frac{160\alpha_0}{3(x-2)^4}-\frac{4d_1\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{4d_1\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+2x\kappa+\frac{160\kappa}{(x-2)^4}+$$

$$\frac{4d_1\kappa}{3(x-1)^4}-\frac{2\kappa}{(x-1)^4}+\frac{640\kappa}{(x-2)^5}+\frac{4d_1\kappa}{3(x-1)^5}-\frac{2\kappa}{(x-1)^5}+\frac{640\kappa}{(x-2)^6}+\frac{160}{3(x-2)^4}+\frac{4d_1}{3(x-1)^4}-\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}+\frac{4d_1}{3(x-1)^5}-$$

$$\frac{2}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{4\alpha_0 d_1^2}{3(x-1)^4}+\frac{4d_1^2}{3(x-1)^4}+\frac{4\alpha_0 d_1^2}{3(x-1)^5}+\frac{4d_1^2}{3(x-1)^5}+\frac{4\alpha_0 d_1}{3}-\frac{2\alpha_0 x d_1}{3}+\frac{2xd_1}{3}+$$

$$\frac{4\alpha_0\kappa d_1}{3}-\frac{2}{3}\alpha_0 x\kappa d_1+\frac{2x\kappa d_1}{3}-\frac{160\alpha_0\kappa d_1}{3(x-2)^4}+\frac{160\kappa d_1}{3(x-2)^4}+\frac{2\alpha_0\kappa d_1}{3(x-1)^4}-\frac{2\kappa d_1}{3(x-1)^4}-\frac{320\alpha_0\kappa d_1}{3(x-2)^5}+\frac{640\kappa d_1}{3(x-2)^5}-\frac{2\alpha_0\kappa d_1}{3(x-1)^5}-$$

$$\frac{2\kappa d_1}{3(x-1)^5}+\frac{640\kappa d_1}{3(x-2)^6}-\frac{160\alpha_0 d_1}{3(x-2)^4}+\frac{160d_1}{3(x-2)^4}+\frac{2\alpha_0 d_1}{3(x-1)^4}-\frac{2d_1}{3(x-1)^4}-\frac{320\alpha_0 d_1}{3(x-2)^5}+\frac{640d_1}{3(x-2)^5}-\frac{2\alpha_0 d_1}{3(x-1)^5}-\frac{2d_1}{3(x-1)^5}+$$

$$\frac{640d_1}{3(x-2)^6}\Big)H(1;\alpha_0)-\frac{62d_1}{9(x-2)}+\frac{32}{9(x-2)}+\frac{65d_1}{9(x-1)}-\frac{43}{12(x-1)}+\frac{70d_1}{9(x-2)^2}-\frac{40}{9(x-2)^2}-\frac{d_1}{(x-1)^2}+\frac{4}{9(x-1)^2}-\frac{80d_1}{9(x-2)^3}+$$

$$\frac{80}{9(x-2)^3}+\frac{5d_1}{18(x-1)^3}+\frac{1}{36(x-1)^3}-\frac{112d_1}{3(x-2)^4}-\frac{64}{9(x-2)^4}-\frac{19d_1}{6(x-1)^4}+\frac{23}{12(x-1)^4}-\frac{448d_1}{3(x-2)^5}-\frac{1216}{9(x-2)^5}-\frac{17d_1}{6(x-1)^5}+$$

$$\frac{17}{12(x-1)^5}-\frac{128d_1}{3(x-2)^6}-\frac{2176}{9(x-2)^6}-\frac{1}{2}\Big)H(1,c_1(\alpha_0);x)+\Big(-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\alpha_0}{(x-2)^5}-\frac{160d_1\alpha_0}{3(x-2)^4}+$$

$$\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}+\frac{160d_1\kappa}{3(x-2)^4}-\frac{160\kappa}{(x-2)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}+\frac{640d_1\kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+\frac{160d_1}{3(x-2)^4}-$$

$$\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Big)H(0;\alpha_0)H(2,1;x)+\Big(-\frac{64\alpha_0 d_1^2}{3(x-2)^4}+\frac{64d_1^2}{3(x-2)^4}-\frac{128\alpha_0 d_1^2}{3(x-2)^5}+$$

$$\frac{256d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^6}+\frac{128\alpha_0\kappa d_1}{3(x-2)^4}-\frac{128\kappa d_1}{3(x-2)^4}+\frac{256\alpha_0\kappa d_1}{3(x-2)^5}-\frac{512\kappa d_1}{3(x-2)^5}-\frac{512\kappa d_1}{3(x-2)^6}-\frac{896\alpha_0 d_1}{9(x-2)^4}+\frac{896d_1}{9(x-2)^4}-\frac{1792\alpha_0 d_1}{9(x-2)^5}+$$

$$\frac{3584d_1}{9(x-2)^5}+\frac{3584d_1}{9(x-2)^6}+\frac{704\alpha_0\kappa}{9(x-2)^4}-\frac{704\kappa}{9(x-2)^4}+\frac{1408\alpha_0\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^6}+\Big(\frac{320d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-$$

$$\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3(x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-$$

$$\frac{320d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3(x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^6}+\frac{1280}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+\frac{640\alpha_0 d_1^2}{3(x-2)^5}-$$

$$\frac{1280d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^6}-\frac{320\alpha_0\kappa d_1}{3(x-2)^4}+\frac{320\kappa d_1}{3(x-2)^4}-\frac{640\alpha_0\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^6}-\frac{320\alpha_0 d_1}{3(x-2)^4}+\frac{320d_1}{3(x-2)^4}-\frac{640\alpha_0 d_1}{3(x-2)^5}+$$

$$\frac{1280d_1}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^6}\Big)H(1;\alpha_0)+\frac{1088\alpha_0}{9(x-2)^4}-\frac{1088}{9(x-2)^4}+\frac{2176\alpha_0}{9(x-2)^5}-\frac{4352}{9(x-2)^5}-\frac{4352}{9(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(\frac{x\alpha_0^5}{12}+$$

$$\frac{1}{4}x\kappa\alpha_0^5+\frac{\kappa\alpha_0^5}{2(x-2)}-\frac{\kappa\alpha_0^5}{4(x-1)}+\frac{\alpha_0^5}{6(x-2)}-\frac{\alpha_0^5}{12(x-1)}-\frac{19x\alpha_0^4}{36}-\frac{19}{12}x\kappa\alpha_0^4-\frac{5\kappa\alpha_0^4}{3(x-2)}+\frac{13\kappa\alpha_0^4}{12(x-1)}+\frac{5\kappa\alpha_0^4}{3(x-2)^2}-\frac{\kappa\alpha_0^4}{3(x-1)^2}+$$

$$\frac{\kappa\alpha_0^4}{6}-\frac{5\alpha_0^4}{9(x-2)}+\frac{13\alpha_0^4}{36(x-1)}+\frac{5\alpha_0^4}{9(x-2)^2}-\frac{\alpha_0^4}{9(x-1)^2}+\frac{\alpha_0^4}{18}+\frac{13x\alpha_0^3}{9}+\frac{13}{3}x\kappa\alpha_0^3+\frac{5\kappa\alpha_0^3}{3(x-2)}-\frac{11\kappa\alpha_0^3}{6(x-1)}-\frac{10\kappa\alpha_0^3}{3(x-2)^2}+\frac{7\kappa\alpha_0^3}{6(x-1)^2}+$$

$$\frac{20\kappa\alpha_0^3}{3(x-2)^3}-\frac{\kappa\alpha_0^3}{2(x-1)^3}-\kappa\alpha_0^3+\frac{5\alpha_0^3}{9(x-2)}-\frac{11\alpha_0^3}{18(x-1)}-\frac{10\alpha_0^3}{9(x-2)^2}+\frac{7\alpha_0^3}{18(x-1)^2}+\frac{20\alpha_0^3}{9(x-2)^3}-\frac{\alpha_0^3}{6(x-1)^3}-\frac{\alpha_0^3}{3}-\frac{7x\alpha_0^2}{3}-$$

$$7x\kappa\alpha_0^2+\frac{3\kappa\alpha_0^2}{2(x-1)}-\frac{3\kappa\alpha_0^2}{2(x-1)^2}+\frac{3\kappa\alpha_0^2}{2(x-1)^3}+\frac{40\kappa\alpha_0^2}{(x-2)^4}-\frac{\kappa\alpha_0^2}{(x-1)^4}+3\kappa\alpha_0^2+\frac{\alpha_0^2}{2(x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{2(x-1)^3}+\frac{40\alpha_0^2}{3(x-2)^4}-$$

$$\frac{\alpha_0^2}{3(x-1)^4}+\alpha_0^2+\frac{73x\alpha_0}{36}+\frac{73x\kappa\alpha_0}{12}+\frac{40\kappa\alpha_0}{3(x-2)}-\frac{65\kappa\alpha_0}{4(x-1)}-\frac{40\kappa\alpha_0}{3(x-2)^2}+\frac{25\kappa\alpha_0}{6(x-1)^2}-\frac{35\kappa\alpha_0}{12(x-1)^3}-\frac{240\kappa\alpha_0}{(x-2)^4}-\frac{83\kappa\alpha_0}{36(x-1)^4}-$$

$$\frac{160\kappa\alpha_0}{(x-2)^5}+\frac{101\kappa\alpha_0}{36(x-1)^5}-\frac{2\kappa\alpha_0}{3}+\frac{40\alpha_0}{9(x-2)}-\frac{65\alpha_0}{12(x-1)}-\frac{40\alpha_0}{9(x-2)^2}+\frac{25\alpha_0}{18(x-1)^2}-\frac{35\alpha_0}{36(x-1)^3}-\frac{80\alpha_0}{(x-2)^4}-\frac{5\alpha_0}{4(x-1)^4}-$$

$$\frac{160\alpha_0}{3(x-2)^5}+\frac{17\alpha_0}{12(x-1)^5}-\frac{2\alpha_0}{9}-\frac{25x}{36}-\frac{25x\kappa}{12}+\frac{32\kappa}{3(x-2)}-\frac{43\kappa}{4(x-1)}-\frac{40\kappa}{3(x-2)^2}+\frac{4\kappa}{3(x-1)^2}+\frac{80\kappa}{3(x-2)^3}+\frac{\kappa}{12(x-1)^3}+$$

$$\frac{160\kappa}{(x-2)^4}+\frac{155\kappa}{36(x-1)^4}+\frac{320\kappa}{(x-2)^5}+\frac{101\kappa}{36(x-1)^5}-\frac{3\kappa}{2}+\Bigg(\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{2\kappa\alpha_0}{(x-1)^5}+\frac{2\alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3(x-1)^5}-\frac{2\kappa}{(x-1)^4}-\frac{2\kappa}{(x-1)^5}-$$

$$\frac{2}{3(x-1)^4}-\frac{2}{3(x-1)^5}\Bigg)H(0;\alpha_0)+\Bigg(\frac{2\alpha_0\kappa d_1}{3(x-1)^4}-\frac{2\kappa d_1}{3(x-1)^4}-\frac{2\alpha_0\kappa d_1}{3(x-1)^5}-\frac{2\kappa d_1}{3(x-1)^5}+\frac{2\alpha_0 d_1}{3(x-1)^4}-\frac{2d_1}{3(x-1)^4}-\frac{2\alpha_0 d_1}{3(x-1)^5}-$$

$$\frac{2d_1}{3(x-1)^5}\Bigg)H(1;\alpha_0)+\frac{32}{9(x-2)}-\frac{43}{12(x-1)}-\frac{40}{9(x-2)^2}+\frac{4}{9(x-1)^2}+\frac{80}{9(x-2)^3}+\frac{1}{36(x-1)^3}+\frac{160}{3(x-2)^4}+\frac{23}{12(x-1)^4}+$$

$$\frac{320}{3(x-2)^5}+\frac{17}{12(x-1)^5}-\frac{1}{2}\Bigg)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(-\frac{32d_1\kappa\alpha_0}{3(x-2)^4}-\frac{352\kappa\alpha_0}{9(x-2)^4}-\frac{64d_1\kappa\alpha_0}{3(x-2)^5}-\frac{704\kappa\alpha_0}{9(x-2)^5}-\frac{32d_1\alpha_0}{3(x-2)^4}-$$

$$\frac{544\alpha_0}{9(x-2)^4}-\frac{64d_1\alpha_0}{3(x-2)^5}-\frac{1088\alpha_0}{9(x-2)^5}+\frac{32d_1\kappa}{3(x-2)^4}+\frac{352\kappa}{9(x-2)^4}+\frac{128d_1\kappa}{3(x-2)^5}+\frac{1408\kappa}{9(x-2)^5}+\frac{128d_1\kappa}{3(x-2)^6}+\frac{1408\kappa}{9(x-2)^6}+\Bigg(\frac{160\kappa\alpha_0}{(x-2)^4}+$$

$$\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{160\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{160\kappa}{(x-2)^4}-\frac{640\kappa}{(x-2)^5}-\frac{640\kappa}{(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{640}{3(x-2)^5}-\frac{640}{3(x-2)^6}\Bigg)H(0;\alpha_0)+$$

$$\Bigg(\frac{160\alpha_0\kappa d_1}{3(x-2)^4}-\frac{160\kappa d_1}{3(x-2)^4}+\frac{320\alpha_0\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^6}+\frac{160\alpha_0 d_1}{3(x-2)^4}-\frac{160d_1}{3(x-2)^4}+\frac{320\alpha_0 d_1}{3(x-2)^5}-\frac{640d_1}{3(x-2)^5}-$$

$$\frac{640d_1}{3(x-2)^6}\Bigg)H(1;\alpha_0)+\frac{32d_1}{3(x-2)^4}+\frac{544}{9(x-2)^4}+\frac{128d_1}{3(x-2)^5}+\frac{2176}{9(x-2)^5}+\frac{128d_1}{3(x-2)^6}+\frac{2176}{9(x-2)^6}\Bigg)H(c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\Bigg(\frac{4x\alpha_0}{3}+4x\kappa\alpha_0+\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{4\kappa\alpha_0}{(x-1)^4}+\frac{640\kappa\alpha_0}{(x-2)^5}-\frac{4\kappa\alpha_0}{(x-1)^5}-8\kappa\alpha_0+\frac{320\alpha_0}{3(x-2)^4}+\frac{4\alpha_0}{3(x-1)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}-$$

$$\frac{8\alpha_0}{3}-\frac{4x}{3}-4x\kappa-\frac{320\kappa}{(x-2)^4}-\frac{4\kappa}{(x-1)^4}-\frac{1280\kappa}{(x-2)^5}-\frac{4\kappa}{(x-1)^5}-\frac{1280\kappa}{(x-2)^6}-\frac{320}{3(x-2)^4}-\frac{4}{3(x-1)^4}-\frac{1280}{3(x-2)^5}-\frac{4}{3(x-1)^5}-$$

$$\frac{1280}{3(x-2)^6}\Bigg)H(0,0,0;\alpha_0)+\Bigg(\frac{4x\alpha_0}{3}+4x\kappa\alpha_0-\frac{320\kappa\alpha_0}{(x-2)^4}-\frac{4\kappa\alpha_0}{(x-1)^4}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{4\kappa\alpha_0}{(x-1)^5}-8\kappa\alpha_0-\frac{320\alpha_0}{3(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-$$

$$\frac{640\alpha_0}{3(x-2)^5}+\frac{4\alpha_0}{3(x-1)^5}-\frac{8\alpha_0}{3}-\frac{4x}{3}-4x\kappa+\frac{320\kappa}{(x-2)^4}+\frac{4\kappa}{(x-1)^4}+\frac{1280\kappa}{(x-2)^5}+\frac{4\kappa}{(x-1)^5}+\frac{1280\kappa}{(x-2)^6}+\frac{320}{3(x-2)^4}+\frac{4}{3(x-1)^4}+$$

$$\frac{1280}{3(x-2)^5}+\frac{4}{3(x-1)^5}+\frac{1280}{3(x-2)^6}\Bigg)H(0,0,0;x)+\Bigg(-\frac{8\alpha_0 d_1}{3}+\frac{4\alpha_0 x d_1}{3}-\frac{4xd_1}{3}-\frac{8\alpha_0\kappa d_1}{3}+\frac{4}{3}\alpha_0 x\kappa d_1-\frac{4x\kappa d_1}{3}+$$

$$\frac{320\alpha_0\kappa d_1}{3(x-2)^4}-\frac{320\kappa d_1}{3(x-2)^4}+\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}+\frac{640\alpha_0\kappa d_1}{3(x-2)^5}-\frac{1280\kappa d_1}{3(x-2)^5}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}-\frac{1280\kappa d_1}{3(x-2)^6}+\frac{320\alpha_0 d_1}{3(x-2)^4}-$$

$$\frac{320d_1}{3(x-2)^4}+\frac{4\alpha_0 d_1}{3(x-1)^4}-\frac{4d_1}{3(x-1)^4}+\frac{640\alpha_0 d_1}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^5}-\frac{4\alpha_0 d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}-\frac{1280d_1}{3(x-2)^6}\Bigg)H(0,0,1;\alpha_0)+\Bigg(-$$

$$\frac{2x\alpha_0}{3}-2x\kappa\alpha_0-\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{320\kappa\alpha_0}{(x-2)^5}-\frac{2\kappa\alpha_0}{(x-1)^5}+4\kappa\alpha_0-\frac{160\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+$$

$$\frac{4\alpha_0}{3}+\frac{2x}{3}+2x\kappa+\frac{160\kappa}{(x-2)^4}-\frac{2\kappa}{(x-1)^4}+\frac{640\kappa}{(x-2)^5}-\frac{2\kappa}{(x-1)^5}+\frac{640\kappa}{(x-2)^6}+\frac{160}{3(x-2)^4}-\frac{2}{3(x-1)^4}+\frac{640}{3(x-2)^5}-\frac{2}{3(x-1)^5}+$$

$$\frac{640}{3(x-2)^6}\Bigg)H(0,0,c_1(\alpha_0);x)+\Bigg(\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320\alpha_0}{3(x-2)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{320\kappa}{(x-2)^4}-\frac{1280\kappa}{(x-2)^5}-\frac{1280\kappa}{(x-2)^6}-\frac{320}{3(x-2)^4}-$$

$$\frac{1280}{3(x-2)^5}-\frac{1280}{3(x-2)^6}\Bigg)H(0,0,c_2(\alpha_0);x)+\Bigg(-\frac{8\alpha_0 d_1}{3}+\frac{4\alpha_0 x d_1}{3}-\frac{4xd_1}{3}-\frac{8\alpha_0\kappa d_1}{3}+\frac{4}{3}\alpha_0 x\kappa d_1-\frac{4x\kappa d_1}{3}+$$

$$\frac{320\alpha_0\kappa d_1}{3(x-2)^4}-\frac{320\kappa d_1}{3(x-2)^4}+\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}+\frac{640\alpha_0\kappa d_1}{3(x-2)^5}-\frac{1280\kappa d_1}{3(x-2)^5}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}-\frac{1280\kappa d_1}{3(x-2)^6}+\frac{320\alpha_0 d_1}{3(x-2)^4}-$$

$$\frac{320d_1}{3(x-2)^4}+\frac{4\alpha_0 d_1}{3(x-1)^4}-\frac{4d_1}{3(x-1)^4}+\frac{640\alpha_0 d_1}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^5}-\frac{4\alpha_0 d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}-\frac{1280d_1}{3(x-2)^6}\Bigg)H(0,1,0;\alpha_0)+\Bigg(\frac{4d_1\alpha_0}{3}-$$

$$\frac{2d_1x\alpha_0}{3}+\frac{2x\alpha_0}{3}+\frac{4d_1\kappa\alpha_0}{3}-\frac{2}{3}d_1x\kappa\alpha_0+2x\kappa\alpha_0-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{2d_1\kappa\alpha_0}{3(x-1)^4}-\frac{2\kappa\alpha_0}{(x-1)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\alpha_0}{(x-2)^5}-$$

$$\frac{2d_1\kappa\alpha_0}{3(x-1)^5}+\frac{2\kappa\alpha_0}{(x-1)^5}-4\kappa\alpha_0-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}+\frac{2d_1\alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3(x-1)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}-\frac{2d_1\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3(x-1)^5}-$$

$$\frac{4\alpha_0}{3}+\frac{2d_1x}{3}-\frac{2x}{3}+\frac{2d_1x\kappa}{3}-2x\kappa+\frac{160d_1\kappa}{3(x-2)^4}-\frac{160\kappa}{(x-2)^4}-\frac{2d_1\kappa}{3(x-1)^4}+\frac{2\kappa}{(x-1)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}-\frac{2d_1\kappa}{3(x-1)^5}+$$

$$\frac{2\kappa}{(x-1)^5}+\frac{640d_1\kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}-\frac{2d_1}{3(x-1)^4}+\frac{2}{3(x-1)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}-\frac{2d_1}{3(x-1)^5}+\frac{2}{3(x-1)^5}+$$

$$\frac{640d_1}{3(x-2)^6}-\frac{640}{3(x-2)^6}\Bigg)H(0,1,0;x)+\Bigg(-\frac{8\alpha_0 d_1^2}{3}+\frac{4}{3}\alpha_0 x d_1^2-\frac{4xd_1^2}{3}+\frac{320\alpha_0 d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+\frac{4\alpha_0 d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}+$$

$$\frac{640\alpha_0 d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^5}-\frac{4\alpha_0 d_1^2}{3(x-1)^5}-\frac{4d_1^2}{3(x-1)^5}-\frac{1280d_1^2}{3(x-2)^6}\Bigg)H(0,1,1;\alpha_0)+\Bigg(-\frac{4d_1\alpha_0}{3}+\frac{2d_1x\alpha_0}{3}-\frac{2x\alpha_0}{3}-\frac{4d_1\kappa\alpha_0}{3}+$$

$$\frac{2}{3}d_1x\kappa\alpha_0-2x\kappa\alpha_0+\frac{160d_1\kappa\alpha_0}{3(x-2)^4}-\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+\frac{2\kappa\alpha_0}{(x-1)^4}+\frac{320d_1\kappa\alpha_0}{3(x-2)^5}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-\frac{2\kappa\alpha_0}{(x-1)^5}+$$

$$4\kappa\alpha_0+\frac{160d_1\alpha_0}{3(x-2)^4}-\frac{160\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^4}+\frac{320d_1\alpha_0}{3(x-2)^5}-\frac{320\alpha_0}{3(x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}-\frac{2d_1x}{3}+$$

$$\frac{2x}{3}-\frac{2d_1x\kappa}{3}+2x\kappa-\frac{160d_1\kappa}{3(x-2)^4}+\frac{160\kappa}{(x-2)^4}+\frac{2d_1\kappa}{3(x-1)^4}-\frac{2\kappa}{(x-1)^4}-\frac{640d_1\kappa}{3(x-2)^5}+\frac{640\kappa}{(x-2)^5}+\frac{2d_1\kappa}{3(x-1)^5}-\frac{2\kappa}{(x-1)^5}-\frac{640d_1\kappa}{3(x-2)^6}+$$

$$\frac{640\kappa}{(x-2)^6}-\frac{160d_1}{3(x-2)^4}+\frac{160}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{2}{3(x-1)^4}-\frac{640d_1}{3(x-2)^5}+\frac{640}{3(x-2)^5}+\frac{2d_1}{3(x-1)^5}-\frac{2}{3(x-1)^5}-\frac{640d_1}{3(x-2)^6}+$$

$$\frac{640}{3(x-2)^6}\Big)H(0,1,c_1(\alpha_0);x)+\Big(-\frac{320 d_1\kappa\alpha_0}{3(x-2)^4}+\frac{320\kappa\alpha_0}{(x-2)^4}-\frac{640 d_1\kappa\alpha_0}{3(x-2)^5}+\frac{640\kappa\alpha_0}{(x-2)^5}-\frac{320 d_1\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^4}-\frac{640 d_1\alpha_0}{3(x-2)^5}+$$
$$\frac{640\alpha_0}{3(x-2)^5}+\frac{320 d_1\kappa}{3(x-2)^4}-\frac{320\kappa}{(x-2)^4}+\frac{1280 d_1\kappa}{3(x-2)^5}-\frac{1280\kappa}{(x-2)^5}+\frac{1280 d_1\kappa}{3(x-2)^6}-\frac{1280\kappa}{(x-2)^6}+\frac{320 d_1}{3(x-2)^4}-\frac{320}{3(x-2)^4}+\frac{1280 d_1}{3(x-2)^5}-$$
$$\frac{1280}{3(x-2)^5}+\frac{1280 d_1}{3(x-2)^6}-\frac{1280}{3(x-2)^6}\Big)H(0,2,0;x)+\Big(\frac{320 d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640 d_1\kappa\alpha_0}{3(x-2)^5}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320 d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+$$
$$\frac{640 d_1\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320 d_1\kappa}{3(x-2)^4}+\frac{320\kappa}{(x-2)^4}-\frac{1280 d_1\kappa}{3(x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280 d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-\frac{320 d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-$$
$$\frac{1280 d_1}{3(x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280 d_1}{3(x-2)^6}+\frac{1280}{3(x-2)^6}\Big)H(0,2,c_2(\alpha_0);x)+\Big(-\frac{x\alpha_0}{3}-x\kappa\alpha_0-\frac{80\kappa\alpha_0}{(x-2)^4}+\frac{\kappa\alpha_0}{(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}-$$
$$\frac{\kappa\alpha_0}{(x-1)^5}+2\kappa\alpha_0-\frac{80\alpha_0}{3(x-2)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}-\frac{\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3}+\frac{x}{3}+x\kappa+\frac{80\kappa}{(x-2)^4}-\frac{\kappa}{(x-1)^4}+\frac{320\kappa}{(x-2)^5}-\frac{\kappa}{(x-1)^5}+$$
$$\frac{320\kappa}{(x-2)^6}+\frac{80}{3(x-2)^4}-\frac{1}{3(x-1)^4}+\frac{320}{3(x-2)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{320\kappa\alpha_0}{(x-2)^5}+$$
$$\frac{160\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{160\kappa}{(x-2)^4}-\frac{640\kappa}{(x-2)^5}-\frac{640\kappa}{(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{640}{3(x-2)^5}-\frac{640}{3(x-2)^6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(\frac{2x\alpha_0}{3}+2x\kappa\alpha_0+\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{4d_1\kappa\alpha_0}{3(x-1)^4}-\frac{2\kappa\alpha_0}{(x-1)^4}+\frac{320\kappa\alpha_0}{(x-2)^5}-\frac{4d_1\kappa\alpha_0}{3(x-1)^5}+\frac{2\kappa\alpha_0}{(x-1)^5}-4\kappa\alpha_0+\frac{160\alpha_0}{3(x-2)^4}+\frac{4d_1\alpha_0}{3(x-1)^4}-$$
$$\frac{2\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{4d_1\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-2x\kappa-\frac{160\kappa}{(x-2)^4}-\frac{4d_1\kappa}{3(x-1)^4}+\frac{2\kappa}{(x-1)^4}-\frac{640\kappa}{(x-2)^5}-\frac{4d_1\kappa}{3(x-1)^5}+$$
$$\frac{2\kappa}{(x-1)^5}-\frac{640\kappa}{(x-2)^6}-\frac{160}{3(x-2)^4}-\frac{4d_1}{3(x-1)^4}+\frac{2}{3(x-1)^4}-\frac{640}{3(x-2)^5}-\frac{4d_1}{3(x-1)^5}+\frac{2}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Big)H(1,0,0;x)+\Big(-$$
$$\frac{x\alpha_0}{3}-x\kappa\alpha_0-\frac{80\kappa\alpha_0}{(x-2)^4}-\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+\frac{\kappa\alpha_0}{(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-\frac{\kappa\alpha_0}{(x-1)^5}+2\kappa\alpha_0-\frac{80\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^4}-$$
$$\frac{160\alpha_0}{3(x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-\frac{\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3}+\frac{x}{3}+x\kappa+\frac{80\kappa}{(x-2)^4}+\frac{2d_1\kappa}{3(x-1)^4}-\frac{\kappa}{(x-1)^4}+\frac{320\kappa}{(x-2)^5}+\frac{2d_1\kappa}{3(x-1)^5}-\frac{\kappa}{(x-1)^5}+$$
$$\frac{320\kappa}{(x-2)^6}+\frac{80}{3(x-2)^4}+\frac{2d_1}{3(x-1)^4}-\frac{1}{3(x-1)^4}+\frac{320}{3(x-2)^5}+\frac{2d_1}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-$$
$$\frac{4\alpha_0 d_1^2}{3(x-1)^4}+\frac{4d_1^2}{3(x-1)^4}+\frac{4\alpha_0 d_1^2}{3(x-1)^5}+\frac{4d_1^2}{3(x-1)^5}+\frac{4\alpha_0 d_1}{3}-\frac{2\alpha_0 x d_1}{3}+\frac{2xd_1}{3}+\frac{4\alpha_0\kappa d_1}{3}-\frac{2}{3}\alpha_0 x\kappa d_1+\frac{2x\kappa d_1}{3}-\frac{160\alpha_0\kappa d_1}{3(x-2)^4}+$$
$$\frac{160\kappa d_1}{3(x-2)^4}+\frac{4\alpha_0\kappa d_1}{3(x-1)^4}-\frac{4\kappa d_1}{3(x-1)^4}-\frac{320\alpha_0\kappa d_1}{3(x-2)^5}+\frac{640\kappa d_1}{3(x-2)^5}-\frac{4\alpha_0\kappa d_1}{3(x-1)^5}-\frac{4\kappa d_1}{3(x-1)^5}+\frac{640\kappa d_1}{3(x-2)^6}-\frac{160\alpha_0 d_1}{3(x-2)^4}+\frac{160 d_1}{3(x-2)^4}+$$
$$\frac{4\alpha_0 d_1}{3(x-1)^4}-\frac{4d_1}{3(x-1)^4}-\frac{320\alpha_0 d_1}{3(x-2)^5}+\frac{640 d_1}{3(x-2)^5}-\frac{4\alpha_0 d_1}{3(x-1)^5}-\frac{4d_1}{3(x-1)^5}+\frac{640 d_1}{3(x-2)^6}-\frac{2\alpha_0}{3}+\frac{\alpha_0 x}{3}-\frac{x}{3}-2\alpha_0\kappa+\alpha_0 x\kappa-$$
$$x\kappa+\frac{80\alpha_0\kappa}{(x-2)^4}-\frac{80\kappa}{(x-2)^4}-\frac{\alpha_0\kappa}{(x-1)^4}+\frac{\kappa}{(x-1)^4}+\frac{160\alpha_0\kappa}{(x-2)^5}-\frac{320\kappa}{(x-2)^5}+\frac{\alpha_0\kappa}{(x-1)^5}+\frac{\kappa}{(x-1)^5}-\frac{320\kappa}{(x-2)^6}+\frac{80\alpha_0}{3(x-2)^4}-\frac{80}{3(x-2)^4}-$$
$$\frac{\alpha_0}{3(x-1)^4}+\frac{1}{3(x-1)^4}+\frac{160\alpha_0}{3(x-2)^5}-\frac{320}{3(x-2)^5}+\frac{\alpha_0}{3(x-1)^5}+\frac{1}{3(x-1)^5}-\frac{320}{3(x-2)^6}\Big)H(1,1,0;x)+\Big(\frac{4\alpha_0 d_1^2}{3(x-1)^4}-\frac{4d_1^2}{3(x-1)^4}-$$
$$\frac{4\alpha_0 d_1^2}{3(x-1)^5}-\frac{4d_1^2}{3(x-1)^5}-\frac{4\alpha_0 d_1}{3}+\frac{2\alpha_0 x d_1}{3}-\frac{2xd_1}{3}-\frac{4\alpha_0\kappa d_1}{3}+\frac{2}{3}\alpha_0 x\kappa d_1-\frac{2x\kappa d_1}{3}+\frac{160\alpha_0\kappa d_1}{3(x-2)^4}-\frac{160\kappa d_1}{3(x-2)^4}-\frac{4\alpha_0\kappa d_1}{3(x-1)^4}+$$
$$\frac{4\kappa d_1}{3(x-1)^4}+\frac{320\alpha_0\kappa d_1}{3(x-2)^5}-\frac{640\kappa d_1}{3(x-2)^5}+\frac{4\alpha_0\kappa d_1}{3(x-1)^5}+\frac{4\kappa d_1}{3(x-1)^5}-\frac{640\kappa d_1}{3(x-2)^6}+\frac{160\alpha_0 d_1}{3(x-2)^4}-\frac{160 d_1}{3(x-2)^4}-\frac{4\alpha_0 d_1}{3(x-1)^4}+\frac{4d_1}{3(x-1)^4}+$$
$$\frac{320\alpha_0 d_1}{3(x-2)^5}-\frac{640 d_1}{3(x-2)^5}+\frac{4\alpha_0 d_1}{3(x-1)^5}+\frac{4d_1}{3(x-1)^5}-\frac{640 d_1}{3(x-2)^6}+\frac{2\alpha_0}{3}-\frac{\alpha_0 x}{3}+\frac{x}{3}+2\alpha_0\kappa-\alpha_0 x\kappa+x\kappa-\frac{80\alpha_0\kappa}{(x-2)^4}+\frac{80\kappa}{(x-2)^4}+$$
$$\frac{\alpha_0\kappa}{(x-1)^4}-\frac{\kappa}{(x-1)^4}-\frac{160\alpha_0\kappa}{(x-2)^5}+\frac{320\kappa}{(x-2)^5}-\frac{\alpha_0\kappa}{(x-1)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}-\frac{80\alpha_0}{3(x-2)^4}+\frac{80}{3(x-2)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{1}{3(x-1)^4}-$$
$$\frac{160\alpha_0}{3(x-2)^5}+\frac{320}{3(x-2)^5}-\frac{\alpha_0}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{x\alpha_0}{3}-x\kappa\alpha_0-\frac{80\kappa\alpha_0}{(x-2)^4}-$$
$$\frac{2d_1\kappa\alpha_0}{3(x-1)^4}+\frac{\kappa\alpha_0}{(x-1)^4}-\frac{160\kappa\alpha_0}{(x-2)^5}+\frac{2d_1\kappa\alpha_0}{3(x-1)^5}-\frac{\kappa\alpha_0}{(x-1)^5}+2\kappa\alpha_0-\frac{80\alpha_0}{3(x-2)^4}-\frac{2d_1\alpha_0}{3(x-1)^4}+\frac{\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{3(x-2)^5}+\frac{2d_1\alpha_0}{3(x-1)^5}-$$
$$\frac{\alpha_0}{3(x-1)^5}+\frac{2\alpha_0}{3}+\frac{x}{3}+x\kappa+\frac{80\kappa}{(x-2)^4}+\frac{2d_1\kappa}{3(x-1)^4}-\frac{\kappa}{(x-1)^4}+\frac{320\kappa}{(x-2)^5}+\frac{2d_1\kappa}{3(x-1)^5}-\frac{\kappa}{(x-1)^5}+\frac{320\kappa}{(x-2)^6}+\frac{80}{3(x-2)^4}+$$
$$\frac{2d_1}{3(x-1)^4}-\frac{1}{3(x-1)^4}+\frac{320}{3(x-2)^5}+\frac{2d_1}{3(x-1)^5}-\frac{1}{3(x-1)^5}+\frac{320}{3(x-2)^6}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{320d_1\kappa\alpha_0}{3(x-2)^4}+$$
$$\frac{320\kappa\alpha_0}{(x-2)^4}-\frac{640d_1\kappa\alpha_0}{3(x-2)^5}+\frac{640\kappa\alpha_0}{(x-2)^5}-\frac{320d_1\alpha_0}{3(x-2)^4}+\frac{320\alpha_0}{3(x-2)^4}-\frac{640d_1\alpha_0}{3(x-2)^5}+\frac{640\alpha_0}{3(x-2)^5}+\frac{320d_1\kappa}{3(x-2)^4}-\frac{320\kappa}{(x-2)^4}+\frac{1280d_1\kappa}{3(x-2)^5}-$$
$$\frac{1280\kappa}{(x-2)^5}+\frac{1280d_1\kappa}{3(x-2)^6}-\frac{1280\kappa}{(x-2)^6}+\frac{320d_1}{3(x-2)^4}-\frac{320}{3(x-2)^4}+\frac{1280d_1}{3(x-2)^5}-\frac{1280}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^6}-\frac{1280}{3(x-2)^6}\Big)H(2,0,0;x)+$$
$$\Big(-\frac{160d_1\kappa\alpha_0}{3(x-2)^4}+\frac{160\kappa\alpha_0}{(x-2)^4}-\frac{320d_1\kappa\alpha_0}{3(x-2)^5}+\frac{320\kappa\alpha_0}{(x-2)^5}-\frac{160d_1\alpha_0}{3(x-2)^4}+\frac{160\alpha_0}{3(x-2)^4}-\frac{320d_1\alpha_0}{3(x-2)^5}+\frac{320\alpha_0}{3(x-2)^5}+\frac{160d_1\kappa}{3(x-2)^4}-$$
$$\frac{160\kappa}{(x-2)^4}+\frac{640d_1\kappa}{3(x-2)^5}-\frac{640\kappa}{(x-2)^5}+\frac{640d_1\kappa}{3(x-2)^6}-\frac{640\kappa}{(x-2)^6}+\frac{160d_1}{3(x-2)^4}-\frac{160}{3(x-2)^4}+\frac{640d_1}{3(x-2)^5}-\frac{640}{3(x-2)^5}+\frac{640d_1}{3(x-2)^6}-$$
$$\frac{640}{3(x-2)^6}\Big)H(2,0,c_1(\alpha_0);x)+\Big(\frac{320d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3(x-2)^5}-$$
$$\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3(x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-\frac{320d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3(x-2)^5}+$$
$$\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^6}+\frac{1280}{3(x-2)^6}\Big)H(2,0,c_2(\alpha_0);x)+\Big(\frac{160d_1\kappa\alpha_0}{3(x-2)^4}-\frac{160\kappa\alpha_0}{(x-2)^4}+\frac{320d_1\kappa\alpha_0}{3(x-2)^5}-\frac{320\kappa\alpha_0}{(x-2)^5}+\frac{160d_1\alpha_0}{3(x-2)^4}-$$

$$\frac{160\alpha_0}{3(x-2)^4} + \frac{320 d_1\alpha_0}{3(x-2)^5} - \frac{320\alpha_0}{3(x-2)^5} - \frac{160 d_1\kappa}{3(x-2)^4} + \frac{160\kappa}{(x-2)^4} - \frac{640 d_1\kappa}{3(x-2)^5} + \frac{640\kappa}{(x-2)^5} - \frac{640 d_1\kappa}{3(x-2)^6} + \frac{640\kappa}{(x-2)^6} - \frac{160 d_1}{3(x-2)^4} +$$
$$\frac{160}{3(x-2)^4} - \frac{640 d_1}{3(x-2)^5} + \frac{640}{3(x-2)^5} - \frac{640 d_1}{3(x-2)^6} + \frac{640}{3(x-2)^6}\Big) H(2,1,0;x) + \Big(-\frac{160 d_1\kappa\alpha_0}{3(x-2)^4} + \frac{160\kappa\alpha_0}{(x-2)^4} - \frac{320 d_1\kappa\alpha_0}{3(x-2)^5} +$$
$$\frac{320\kappa\alpha_0}{(x-2)^5} - \frac{160 d_1\alpha_0}{3(x-2)^4} + \frac{160\alpha_0}{3(x-2)^4} - \frac{320 d_1\alpha_0}{3(x-2)^5} + \frac{320\alpha_0}{3(x-2)^5} + \frac{160 d_1\kappa}{3(x-2)^4} - \frac{160\kappa}{(x-2)^4} + \frac{640 d_1\kappa}{3(x-2)^5} - \frac{640\kappa}{(x-2)^5} + \frac{640 d_1\kappa}{3(x-2)^6} - \frac{640\kappa}{(x-2)^6} +$$
$$\frac{160 d_1}{3(x-2)^4} - \frac{160}{3(x-2)^4} + \frac{640 d_1}{3(x-2)^5} - \frac{640}{3(x-2)^5} + \frac{640 d_1}{3(x-2)^6} - \frac{640}{3(x-2)^6}\Big) H(2,1,c_1(\alpha_0);x) + \Big(-\frac{320\alpha_0 d_1^2}{3(x-2)^4} + \frac{320 d_1^2}{3(x-2)^4} -$$
$$\frac{640\alpha_0 d_1^2}{3(x-2)^5} + \frac{1280 d_1^2}{3(x-2)^5} + \frac{1280 d_1^2}{3(x-2)^6} + \frac{640\alpha_0\kappa d_1}{3(x-2)^4} - \frac{640\kappa d_1}{3(x-2)^4} + \frac{1280\alpha_0\kappa d_1}{3(x-2)^5} - \frac{2560\kappa d_1}{3(x-2)^5} - \frac{2560\kappa d_1}{3(x-2)^6} + \frac{640\alpha_0 d_1}{3(x-2)^4} - \frac{640 d_1}{3(x-2)^4} +$$
$$\frac{1280\alpha_0 d_1}{3(x-2)^5} - \frac{2560 d_1}{3(x-2)^5} - \frac{2560 d_1}{3(x-2)^6} - \frac{320\alpha_0\kappa}{(x-2)^4} + \frac{320\kappa}{(x-2)^4} - \frac{640\alpha_0\kappa}{(x-2)^5} + \frac{1280\kappa}{(x-2)^5} + \frac{1280\kappa}{(x-2)^6} - \frac{320\alpha_0}{3(x-2)^4} + \frac{320}{3(x-2)^4} - \frac{640\alpha_0}{3(x-2)^5} +$$
$$\frac{1280}{3(x-2)^5} + \frac{1280}{3(x-2)^6}\Big) H(2,2,0;x) + \Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4} - \frac{320 d_1^2}{3(x-2)^4} + \frac{640\alpha_0 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^6} - \frac{640\alpha_0\kappa d_1}{3(x-2)^4} +$$
$$\frac{640\kappa d_1}{3(x-2)^4} - \frac{1280\alpha_0\kappa d_1}{3(x-2)^5} + \frac{2560\kappa d_1}{3(x-2)^5} + \frac{2560\kappa d_1}{3(x-2)^6} - \frac{640\alpha_0 d_1}{3(x-2)^4} + \frac{640 d_1}{3(x-2)^4} - \frac{1280\alpha_0 d_1}{3(x-2)^5} + \frac{2560 d_1}{3(x-2)^5} + \frac{2560 d_1}{3(x-2)^6} + \frac{320\alpha_0\kappa}{(x-2)^4} -$$
$$\frac{320\kappa}{(x-2)^4} + \frac{640\alpha_0\kappa}{(x-2)^5} - \frac{1280\kappa}{(x-2)^5} - \frac{1280\kappa}{(x-2)^6} + \frac{320\alpha_0}{3(x-2)^4} - \frac{320}{3(x-2)^4} + \frac{640\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(2,2,c_2(\alpha_0);x) +$$
$$\Big(\frac{160 d_1\kappa\alpha_0}{3(x-2)^4} - \frac{160\kappa\alpha_0}{(x-2)^4} + \frac{320 d_1\kappa\alpha_0}{3(x-2)^5} - \frac{320\kappa\alpha_0}{(x-2)^5} + \frac{160 d_1\alpha_0}{3(x-2)^4} - \frac{160\alpha_0}{3(x-2)^4} + \frac{320 d_1\alpha_0}{3(x-2)^5} - \frac{320\alpha_0}{3(x-2)^5} - \frac{160 d_1\kappa}{3(x-2)^4} +$$
$$\frac{160\kappa}{(x-2)^4} - \frac{640 d_1\kappa}{3(x-2)^5} + \frac{640\kappa}{(x-2)^5} - \frac{640 d_1\kappa}{3(x-2)^6} + \frac{640\kappa}{(x-2)^6} - \frac{160 d_1}{3(x-2)^4} + \frac{160}{3(x-2)^4} - \frac{640 d_1}{3(x-2)^5} + \frac{640}{3(x-2)^5} - \frac{640 d_1}{3(x-2)^6} +$$
$$\frac{640}{3(x-2)^6}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\kappa\alpha_0}{(x-1)^4} - \frac{\kappa\alpha_0}{(x-1)^5} + \frac{\alpha_0}{3(x-1)^4} - \frac{\alpha_0}{3(x-1)^5} - \frac{\kappa}{(x-1)^4} - \frac{\kappa}{(x-1)^5} - \frac{1}{3(x-1)^4} -$$
$$\frac{1}{3(x-1)^5}\Big) H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{80\kappa\alpha_0}{(x-2)^4} + \frac{160\kappa\alpha_0}{(x-2)^5} + \frac{80\alpha_0}{3(x-2)^4} + \frac{160\alpha_0}{3(x-2)^5} - \frac{80\kappa}{(x-2)^4} - \frac{320\kappa}{(x-2)^5} - \frac{320\kappa}{(x-2)^6} -$$
$$\frac{80}{3(x-2)^4} - \frac{320}{3(x-2)^5} - \frac{320}{3(x-2)^6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + H(0,0;x)\Big(-\frac{17x\alpha_0}{6} - \frac{101x\kappa\alpha_0}{18} - \frac{80\kappa\alpha_0}{3(x-2)} +$$
$$\frac{65\kappa\alpha_0}{2(x-1)} + \frac{80\kappa\alpha_0}{3(x-2)^2} - \frac{25\kappa\alpha_0}{3(x-1)^2} + \frac{35\kappa\alpha_0}{6(x-1)^3} + \frac{64 d_1\kappa\alpha_0}{3(x-2)^4} + \frac{3584\kappa\alpha_0}{9(x-2)^4} + \frac{47\kappa\alpha_0}{18(x-1)^4} + \frac{128 d_1\kappa\alpha_0}{3(x-2)^5} + \frac{1408\kappa\alpha_0}{9(x-2)^5} - \frac{101\kappa\alpha_0}{18(x-1)^5} +$$
$$\frac{74\kappa\alpha_0}{9} - \frac{80\alpha_0}{9(x-2)} + \frac{65\alpha_0}{6(x-1)} + \frac{80\alpha_0}{9(x-2)^2} - \frac{25\alpha_0}{9(x-1)^2} + \frac{35\alpha_0}{18(x-1)^3} + \frac{64 d_1\alpha_0}{3(x-2)^4} + \frac{2048\alpha_0}{9(x-2)^4} + \frac{11\alpha_0}{6(x-1)^4} + \frac{128 d_1\alpha_0}{3(x-2)^5} +$$
$$\frac{2176\alpha_0}{9(x-2)^5} - \frac{17\alpha_0}{6(x-1)^5} + \frac{320\kappa\ln 2\,\alpha_0}{(x-2)^4} + \frac{640\kappa\ln 2\,\alpha_0}{(x-2)^5} + \frac{320\ln 2\,\alpha_0}{3(x-2)^4} + \frac{640\ln 2\,\alpha_0}{3(x-2)^5} + \frac{14\alpha_0}{3} + \frac{17x}{6} + \frac{101x\kappa}{18} - \frac{64\kappa}{3(x-2)} +$$
$$\frac{43\kappa}{2(x-1)} + \frac{80\kappa}{3(x-2)^2} - \frac{8\kappa}{3(x-1)^2} - \frac{160\kappa}{3(x-2)^3} - \frac{\kappa}{6(x-1)^3} - \frac{64 d_1\kappa}{3(x-2)^4} - \frac{3584\kappa}{9(x-2)^4} - \frac{155\kappa}{18(x-1)^4} - \frac{256 d_1\kappa}{3(x-2)^5} - \frac{8576\kappa}{9(x-2)^5} -$$
$$\frac{101\kappa}{18(x-1)^5} - \frac{256 d_1\kappa}{3(x-2)^6} - \frac{2816\kappa}{9(x-2)^6} + 3\kappa - \frac{64}{9(x-2)} + \frac{43}{6(x-1)} + \frac{80}{9(x-2)^2} - \frac{8}{9(x-1)^2} - \frac{160}{9(x-2)^3} - \frac{1}{18(x-1)^3} - \frac{64 d_1}{3(x-2)^4} -$$
$$\frac{2048}{9(x-2)^4} - \frac{23}{6(x-1)^4} - \frac{256 d_1}{3(x-2)^5} - \frac{6272}{9(x-2)^5} - \frac{17}{6(x-1)^5} - \frac{256 d_1}{3(x-2)^6} - \frac{4352}{9(x-2)^6} - \frac{320\kappa\ln 2}{(x-2)^4} - \frac{1280\kappa\ln 2}{(x-2)^5} - \frac{1280\kappa\ln 2}{(x-2)^6} -$$
$$\frac{320\ln 2}{3(x-2)^4} - \frac{1280\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{3(x-2)^6} + 1\Big) + H(2,2;x)\Big(\frac{320\alpha_0\ln 2\, d_1^2}{3(x-2)^4} - \frac{320\ln 2\, d_1^2}{3(x-2)^4} + \frac{640\alpha_0\ln 2\, d_1^2}{3(x-2)^5} - \frac{1280\ln 2\, d_1^2}{3(x-2)^5} -$$
$$\frac{1280\ln 2\, d_1^2}{3(x-2)^6} - \frac{640\alpha_0\kappa\ln 2\, d_1}{3(x-2)^4} + \frac{640\kappa\ln 2\, d_1}{3(x-2)^4} - \frac{1280\alpha_0\kappa\ln 2\, d_1}{3(x-2)^5} + \frac{2560\kappa\ln 2\, d_1}{3(x-2)^5} + \frac{2560\kappa\ln 2\, d_1}{3(x-2)^6} - \frac{640\alpha_0\ln 2\, d_1}{3(x-2)^4} +$$
$$\frac{640\ln 2\, d_1}{3(x-2)^4} - \frac{1280\alpha_0\ln 2\, d_1}{3(x-2)^5} + \frac{2560\ln 2\, d_1}{3(x-2)^5} + \frac{2560\ln 2\, d_1}{3(x-2)^6} + \Big(\frac{320\alpha_0 d_1^2}{3(x-2)^4} - \frac{320 d_1^2}{3(x-2)^4} + \frac{640\alpha_0 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^5} - \frac{1280 d_1^2}{3(x-2)^6} -$$
$$\frac{640\alpha_0\kappa d_1}{3(x-2)^4} + \frac{640\kappa d_1}{3(x-2)^4} - \frac{1280\alpha_0\kappa d_1}{3(x-2)^5} + \frac{2560\kappa d_1}{3(x-2)^5} + \frac{2560\kappa d_1}{3(x-2)^6} - \frac{640\alpha_0 d_1}{3(x-2)^4} + \frac{640 d_1}{3(x-2)^4} - \frac{1280\alpha_0 d_1}{3(x-2)^5} + \frac{2560 d_1}{3(x-2)^5} + \frac{2560 d_1}{3(x-2)^6} +$$
$$\frac{320\alpha_0\kappa}{(x-2)^4} - \frac{320\kappa}{(x-2)^4} + \frac{640\alpha_0\kappa}{(x-2)^5} - \frac{1280\kappa}{(x-2)^5} - \frac{1280\kappa}{(x-2)^6} + \frac{320\alpha_0}{3(x-2)^4} - \frac{320}{3(x-2)^4} + \frac{640\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(0;\alpha_0) +$$
$$\frac{320\alpha_0\kappa\ln 2}{(x-2)^4} - \frac{320\kappa\ln 2}{(x-2)^4} + \frac{640\alpha_0\kappa\ln 2}{(x-2)^5} - \frac{1280\kappa\ln 2}{(x-2)^5} - \frac{1280\kappa\ln 2}{(x-2)^6} + \frac{320\alpha_0\ln 2}{3(x-2)^4} - \frac{320\ln 2}{3(x-2)^4} + \frac{640\alpha_0\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{3(x-2)^5} -$$
$$\frac{1280\ln 2}{3(x-2)^6}\Big) + H(2,0;x)\Big(\frac{64\alpha_0 d_1^2}{3(x-2)^4} - \frac{64 d_1^2}{3(x-2)^4} + \frac{128\alpha_0 d_1^2}{3(x-2)^5} - \frac{256 d_1^2}{3(x-2)^5} - \frac{256 d_1^2}{3(x-2)^6} - \frac{128\alpha_0\kappa d_1}{3(x-2)^4} + \frac{128\kappa d_1}{3(x-2)^4} - \frac{256\alpha_0\kappa d_1}{3(x-2)^5} +$$
$$\frac{512\kappa d_1}{3(x-2)^5} + \frac{512\kappa d_1}{3(x-2)^6} + \frac{896\alpha_0 d_1}{9(x-2)^4} - \frac{896 d_1}{9(x-2)^4} + \frac{1792\alpha_0 d_1}{9(x-2)^5} - \frac{3584 d_1}{9(x-2)^5} - \frac{3584 d_1}{9(x-2)^6} + \frac{320\alpha_0\kappa\ln 2\, d_1}{3(x-2)^4} - \frac{320\kappa\ln 2\, d_1}{3(x-2)^4} +$$
$$\frac{640\alpha_0\kappa\ln 2\, d_1}{3(x-2)^5} - \frac{1280\kappa\ln 2\, d_1}{3(x-2)^5} - \frac{1280\kappa\ln 2\, d_1}{3(x-2)^6} + \frac{320\alpha_0\ln 2\, d_1}{3(x-2)^4} - \frac{320\ln 2\, d_1}{3(x-2)^4} + \frac{640\alpha_0\ln 2\, d_1}{3(x-2)^5} - \frac{1280\ln 2\, d_1}{3(x-2)^5} - \frac{1280\ln 2\, d_1}{3(x-2)^6} -$$
$$\frac{704\alpha_0\kappa}{9(x-2)^4} + \frac{704\kappa}{9(x-2)^4} - \frac{1408\alpha_0\kappa}{9(x-2)^5} + \frac{2816\kappa}{9(x-2)^5} + \frac{2816\kappa}{9(x-2)^6} - \frac{1088\alpha_0}{9(x-2)^4} + \frac{1088}{9(x-2)^4} - \frac{2176\alpha_0}{9(x-2)^5} + \frac{4352}{9(x-2)^5} + \frac{4352}{9(x-2)^6} -$$
$$\frac{320\alpha_0\kappa\ln 2}{(x-2)^4} + \frac{320\kappa\ln 2}{(x-2)^4} - \frac{640\alpha_0\kappa\ln 2}{(x-2)^5} + \frac{1280\kappa\ln 2}{(x-2)^5} + \frac{1280\kappa\ln 2}{(x-2)^6} - \frac{320\alpha_0\ln 2}{3(x-2)^4} + \frac{320\ln 2}{3(x-2)^4} - \frac{640\alpha_0\ln 2}{3(x-2)^5} + \frac{1280\ln 2}{3(x-2)^5} +$$
$$\frac{1280\ln 2}{3(x-2)^6}\Big) + H(0,2;x)\Big(\frac{320 d_1\kappa\ln 2\,\alpha_0}{3(x-2)^4} - \frac{320\kappa\ln 2\,\alpha_0}{(x-2)^4} + \frac{640 d_1\kappa\ln 2\,\alpha_0}{3(x-2)^5} - \frac{640\kappa\ln 2\,\alpha_0}{(x-2)^5} + \frac{320 d_1\ln 2\,\alpha_0}{3(x-2)^4} - \frac{320\ln 2\,\alpha_0}{3(x-2)^4} +$$
$$\frac{640 d_1\ln 2\,\alpha_0}{3(x-2)^5} - \frac{640\ln 2\,\alpha_0}{3(x-2)^5} + \Big(\frac{320 d_1\kappa\alpha_0}{3(x-2)^4} - \frac{320\kappa\alpha_0}{(x-2)^4} + \frac{640 d_1\kappa\alpha_0}{3(x-2)^5} - \frac{640\kappa\alpha_0}{(x-2)^5} + \frac{320 d_1\alpha_0}{3(x-2)^4} - \frac{320\alpha_0}{3(x-2)^4} + \frac{640 d_1\alpha_0}{3(x-2)^5} -$$
$$\frac{640\alpha_0}{3(x-2)^5} - \frac{320 d_1\kappa}{3(x-2)^4} + \frac{320\kappa}{(x-2)^4} - \frac{1280 d_1\kappa}{3(x-2)^5} + \frac{1280\kappa}{(x-2)^5} - \frac{1280 d_1\kappa}{3(x-2)^6} + \frac{1280\kappa}{(x-2)^6} - \frac{320 d_1}{3(x-2)^4} + \frac{320}{3(x-2)^4} - \frac{1280 d_1}{3(x-2)^5} + \frac{1280}{3(x-2)^5} -$$

$$\frac{1280d_1}{3(x-2)^6}+\frac{1280}{3(x-2)^6}\Big)H(0;\alpha_0)-\frac{320d_1\kappa\ln 2}{3(x-2)^4}+\frac{320\kappa\ln 2}{(x-2)^4}-\frac{1280d_1\kappa\ln 2}{3(x-2)^5}+\frac{1280\kappa\ln 2}{(x-2)^5}-\frac{1280d_1\kappa\ln 2}{3(x-2)^6}+\frac{1280\kappa\ln 2}{(x-2)^6}-$$

$$\frac{320d_1\ln 2}{3(x-2)^4}+\frac{320\ln 2}{3(x-2)^4}-\frac{1280d_1\ln 2}{3(x-2)^5}+\frac{1280\ln 2}{3(x-2)^5}-\frac{1280d_1\ln 2}{3(x-2)^6}+\frac{1280\ln 2}{3(x-2)^6}\Big)+H(0;x)\Big(\frac{31d_1\alpha_0}{27}-\frac{205d_1x\alpha_0}{216}+$$

$$\frac{1}{18}\pi^2x\alpha_0+\frac{955x\alpha_0}{216}+\frac{31d_1\kappa\alpha_0}{27}-\frac{205}{216}d_1x\kappa\alpha_0+\frac{1}{3}\pi^2x\kappa\alpha_0+\frac{1255x\kappa\alpha_0}{216}-\frac{392d_1\kappa\alpha_0}{27(x-2)}+\frac{1136\kappa\alpha_0}{27(x-2)}+\frac{1129d_1\kappa\alpha_0}{72(x-1)}-$$

$$\frac{3613\kappa\alpha_0}{72(x-1)}+\frac{392d_1\kappa\alpha_0}{27(x-2)^2}-\frac{1136\kappa\alpha_0}{27(x-2)^2}-\frac{181d_1\kappa\alpha_0}{108(x-1)^2}+\frac{280\kappa\alpha_0}{27(x-1)^2}+\frac{251d_1\kappa\alpha_0}{216(x-1)^3}-\frac{1751\kappa\alpha_0}{216(x-1)^3}+\frac{256d_1\kappa\alpha_0}{3(x-2)^4}-\frac{40\pi^2\kappa\alpha_0}{3(x-2)^4}-$$

$$\frac{3328\kappa\alpha_0}{9(x-2)^4}+\frac{43d_1\kappa\alpha_0}{216(x-1)^4}-\frac{\pi^2\kappa\alpha_0}{3(x-1)^4}-\frac{32\kappa\alpha_0}{27(x-1)^4}-\frac{80\pi^2\kappa\alpha_0}{3(x-2)^5}+\frac{512\kappa\alpha_0}{9(x-2)^5}-\frac{205d_1\kappa\alpha_0}{216(x-1)^5}+\frac{\pi^2\kappa\alpha_0}{3(x-1)^5}+\frac{1255\kappa\alpha_0}{216(x-1)^5}-$$

$$\frac{2}{3}\pi^2\kappa\alpha_0-\frac{1511\kappa\alpha_0}{216}-\frac{392d_1\alpha_0}{27(x-2)}+\frac{592\alpha_0}{27(x-2)}+\frac{1129d_1\alpha_0}{72(x-1)}-\frac{209\alpha_0}{8(x-1)}+\frac{392d_1\alpha_0}{27(x-2)^2}-\frac{592\alpha_0}{27(x-2)^2}-\frac{181d_1\alpha_0}{108(x-1)^2}+\frac{155\alpha_0}{27(x-1)^2}+$$

$$\frac{251d_1\alpha_0}{216(x-1)^3}-\frac{907\alpha_0}{216(x-1)^3}+\frac{512d_1\alpha_0}{9(x-2)^4}-\frac{9536\alpha_0}{27(x-2)^4}+\frac{43d_1\alpha_0}{216(x-1)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}-\frac{115\alpha_0}{54(x-1)^4}-\frac{512d_1\alpha_0}{9(x-2)^5}-\frac{6784\alpha_0}{27(x-2)^5}-$$

$$\frac{205d_1\alpha_0}{216(x-1)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}+\frac{955\alpha_0}{216(x-1)^5}-\frac{160\kappa\ln^2 2\,\alpha_0}{(x-2)^4}-\frac{320\kappa\ln^2 2\,\alpha_0}{(x-2)^5}-\frac{160\ln^2 2\,\alpha_0}{3(x-2)^4}-\frac{320\ln^2 2\,\alpha_0}{3(x-2)^5}-\frac{64d_1\kappa\ln 2\,\alpha_0}{3(x-2)^4}-$$

$$\frac{704\kappa\ln 2\,\alpha_0}{9(x-2)^4}-\frac{128d_1\kappa\ln 2\,\alpha_0}{3(x-2)^5}-\frac{1408\kappa\ln 2\,\alpha_0}{9(x-2)^5}-\frac{64d_1\ln 2\,\alpha_0}{3(x-2)^4}-\frac{1088\ln 2\,\alpha_0}{9(x-2)^4}-\frac{128d_1\ln 2\,\alpha_0}{3(x-2)^5}-\frac{2176\ln 2\,\alpha_0}{9(x-2)^5}-\frac{\pi^2\alpha_0}{9}-$$

$$\frac{1415\alpha_0}{216}+\frac{3d_1}{4}+\frac{205d_1x}{216}-\frac{\pi^2x}{18}-\frac{955x}{216}+\frac{3d_1\kappa}{4}+\frac{205d_1x\kappa}{216}-\frac{1}{3}\pi^2x\kappa-\frac{1255x\kappa}{216}-\frac{346d_1\kappa}{27(x-2)}+\frac{952\kappa}{27(x-2)}+\frac{947d_1\kappa}{72(x-1)}-$$

$$\frac{2621\kappa}{72(x-1)}+\frac{392d_1\kappa}{27(x-2)^2}-\frac{1136\kappa}{27(x-2)^2}-\frac{23d_1\kappa}{27(x-1)^2}+\frac{92\kappa}{27(x-1)^2}-\frac{784d_1\kappa}{27(x-2)^3}+\frac{2272\kappa}{27(x-2)^3}-\frac{73d_1\kappa}{216(x-1)^3}+\frac{247\kappa}{216(x-1)^3}-$$

$$\frac{256d_1\kappa}{3(x-2)^4}+\frac{40\pi^2\kappa}{3(x-2)^4}+\frac{3328\kappa}{9(x-2)^4}-\frac{367d_1\kappa}{216(x-1)^4}+\frac{\pi^2\kappa}{3(x-1)^4}+\frac{1127\kappa}{108(x-1)^4}-\frac{512d_1\kappa}{3(x-2)^5}+\frac{160\pi^2\kappa}{3(x-2)^5}+\frac{2048\kappa}{3(x-2)^5}-\frac{205d_1\kappa}{216(x-1)^5}+$$

$$\frac{\pi^2\kappa}{3(x-1)^5}+\frac{1255\kappa}{216(x-1)^5}+\frac{160\pi^2\kappa}{3(x-2)^6}-\frac{1024\kappa}{9(x-2)^6}-\frac{37\kappa}{8}-\frac{346d_1}{27(x-2)}+\frac{488}{27(x-2)}+\frac{947d_1}{72(x-1)}-\frac{443}{24(x-1)}+\frac{392d_1}{27(x-2)^2}-$$

$$\frac{592}{27(x-2)^2}-\frac{23d_1}{27(x-1)^2}+\frac{52}{27(x-1)^2}-\frac{784d_1}{27(x-2)^3}+\frac{1184}{27(x-2)^3}-\frac{73d_1}{216(x-1)^3}+\frac{83}{216(x-1)^3}-\frac{512d_1}{9(x-2)^4}+\frac{9536}{27(x-2)^4}-$$

$$\frac{367d_1}{216(x-1)^4}+\frac{\pi^2}{18(x-1)^4}+\frac{725}{108(x-1)^4}-\frac{512d_1}{9(x-2)^5}+\frac{25856}{27(x-2)^5}-\frac{205d_1}{216(x-1)^5}+\frac{\pi^2}{18(x-1)^5}+\frac{955}{216(x-1)^5}+\frac{1024d_1}{9(x-2)^6}+$$

$$\frac{13568}{27(x-2)^6}+\frac{160\kappa\ln^2 2}{(x-2)^4}+\frac{640\kappa\ln^2 2}{(x-2)^5}+\frac{640\kappa\ln^2 2}{(x-2)^6}+\frac{160\ln^2 2}{3(x-2)^4}+\frac{640\ln^2 2}{3(x-2)^5}+\frac{640\ln^2 2}{3(x-2)^6}+\frac{64d_1\kappa\ln 2}{3(x-2)^4}+\frac{704\kappa\ln 2}{9(x-2)^4}+$$

$$\frac{256d_1\kappa\ln 2}{3(x-2)^5}+\frac{2816\kappa\ln 2}{9(x-2)^5}+\frac{256d_1\kappa\ln 2}{3(x-2)^6}+\frac{2816\kappa\ln 2}{9(x-2)^6}+\frac{64d_1\ln 2}{3(x-2)^4}+\frac{1088\ln 2}{9(x-2)^4}+\frac{256d_1\ln 2}{3(x-2)^5}+\frac{4352\ln 2}{9(x-2)^5}+\frac{256d_1\ln 2}{3(x-2)^6}+$$

$$\frac{4352\ln 2}{9(x-2)^6}-\frac{55}{24}\Big)+H(2;x)\Big(-\frac{64\alpha_0\ln 2\,d_1^2}{3(x-2)^4}+\frac{64\ln 2\,d_1^2}{3(x-2)^4}-\frac{128\alpha_0\ln 2\,d_1^2}{3(x-2)^5}+\frac{256\ln 2\,d_1^2}{3(x-2)^5}+\frac{256\ln 2\,d_1^2}{3(x-2)^6}-\frac{40\alpha_0\pi^2\kappa d_1}{9(x-2)^4}+$$

$$\frac{40\pi^2\kappa d_1}{9(x-2)^4}-\frac{80\alpha_0\pi^2\kappa d_1}{9(x-2)^5}+\frac{160\pi^2\kappa d_1}{9(x-2)^5}+\frac{160\pi^2\kappa d_1}{9(x-2)^6}-\frac{40\alpha_0\pi^2d_1}{9(x-2)^4}+\frac{40\pi^2d_1}{9(x-2)^4}-\frac{80\alpha_0\pi^2d_1}{9(x-2)^5}+\frac{160\pi^2d_1}{9(x-2)^5}+\frac{160\pi^2d_1}{9(x-2)^6}-$$

$$\frac{160\alpha_0\kappa\ln^2 2\,d_1}{3(x-2)^4}+\frac{160\kappa\ln^2 2\,d_1}{3(x-2)^4}-\frac{320\alpha_0\kappa\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\kappa\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\kappa\ln^2 2\,d_1}{3(x-2)^6}-\frac{160\alpha_0\ln^2 2\,d_1}{3(x-2)^4}+\frac{160\ln^2 2\,d_1}{3(x-2)^4}-$$

$$\frac{320\alpha_0\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\ln^2 2\,d_1}{3(x-2)^5}+\frac{640\ln^2 2\,d_1}{3(x-2)^6}+\frac{128\alpha_0\kappa\ln 2\,d_1}{3(x-2)^4}-\frac{128\kappa\ln 2\,d_1}{3(x-2)^4}+\frac{256\alpha_0\kappa\ln 2\,d_1}{3(x-2)^5}-\frac{512\kappa\ln 2\,d_1}{3(x-2)^5}-\frac{512\kappa\ln 2\,d_1}{3(x-2)^6}-$$

$$\frac{896\alpha_0\ln 2\,d_1}{9(x-2)^4}+\frac{896\ln 2\,d_1}{9(x-2)^4}-\frac{1792\alpha_0\ln 2\,d_1}{9(x-2)^5}+\frac{3584\ln 2\,d_1}{9(x-2)^5}+\frac{3584\ln 2\,d_1}{9(x-2)^6}+\frac{40\alpha_0\pi^2\kappa}{3(x-2)^4}-\frac{40\pi^2\kappa}{3(x-2)^4}+\frac{80\alpha_0\pi^2\kappa}{3(x-2)^5}-\frac{160\pi^2\kappa}{3(x-2)^5}-$$

$$\frac{160\pi^2\kappa}{3(x-2)^6}+\Big(-\frac{64\alpha_0d_1^2}{3(x-2)^4}+\frac{64d_1^2}{3(x-2)^4}-\frac{128\alpha_0d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^5}+\frac{256d_1^2}{3(x-2)^6}+\frac{128\alpha_0\kappa d_1}{3(x-2)^4}-\frac{128\kappa d_1}{3(x-2)^4}+\frac{256\alpha_0\kappa d_1}{3(x-2)^5}-\frac{512\kappa d_1}{3(x-2)^5}-$$

$$\frac{512\kappa d_1}{3(x-2)^6}-\frac{896\alpha_0d_1}{9(x-2)^4}+\frac{896d_1}{9(x-2)^4}-\frac{1792\alpha_0d_1}{9(x-2)^5}+\frac{3584d_1}{9(x-2)^5}+\frac{3584d_1}{9(x-2)^6}+\frac{704\alpha_0\kappa}{9(x-2)^4}-\frac{704\kappa}{9(x-2)^4}+\frac{1408\alpha_0\kappa}{9(x-2)^5}-\frac{2816\kappa}{9(x-2)^5}-$$

$$\frac{2816\kappa}{9(x-2)^6}+\frac{1088\alpha_0}{9(x-2)^4}-\frac{1088}{9(x-2)^4}+\frac{2176\alpha_0}{9(x-2)^5}-\frac{4352}{9(x-2)^5}-\frac{4352}{9(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{320d_1\kappa\alpha_0}{3(x-2)^4}-\frac{320\kappa\alpha_0}{(x-2)^4}+\frac{640d_1\kappa\alpha_0}{3(x-2)^5}-$$

$$\frac{640\kappa\alpha_0}{(x-2)^5}+\frac{320d_1\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^4}+\frac{640d_1\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{3(x-2)^5}-\frac{320d_1\kappa}{3(x-2)^4}+\frac{320\kappa}{(x-2)^4}-\frac{1280d_1\kappa}{3(x-2)^5}+\frac{1280\kappa}{(x-2)^5}-\frac{1280d_1\kappa}{3(x-2)^6}+\frac{1280\kappa}{(x-2)^6}-$$

$$\frac{320d_1}{3(x-2)^4}+\frac{320}{3(x-2)^4}-\frac{1280d_1}{3(x-2)^5}+\frac{1280}{3(x-2)^5}-\frac{1280d_1}{3(x-2)^6}+\frac{1280}{3(x-2)^6}\Big)H(0,0;\alpha_0)+\Big(\frac{320\alpha_0d_1^2}{3(x-2)^4}-\frac{320d_1^2}{3(x-2)^4}+\frac{640\alpha_0d_1^2}{3(x-2)^5}-$$

$$\frac{1280d_1^2}{3(x-2)^5}-\frac{1280d_1^2}{3(x-2)^6}-\frac{320\alpha_0\kappa d_1}{3(x-2)^4}+\frac{320\kappa d_1}{3(x-2)^4}-\frac{640\alpha_0\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^5}+\frac{1280\kappa d_1}{3(x-2)^6}-\frac{320\alpha_0d_1}{3(x-2)^4}+\frac{320d_1}{3(x-2)^4}-\frac{640\alpha_0d_1}{3(x-2)^5}+$$

$$\frac{1280d_1}{3(x-2)^5}+\frac{1280d_1}{3(x-2)^6}\Big)H(0,1;\alpha_0)+\frac{40\alpha_0\pi^2}{9(x-2)^4}-\frac{40\pi^2}{9(x-2)^4}+\frac{80\alpha_0\pi^2}{9(x-2)^5}-\frac{160\pi^2}{9(x-2)^5}-\frac{160\pi^2}{9(x-2)^6}+\frac{160\alpha_0\kappa\ln^2 2}{(x-2)^4}-$$

$$\frac{160\kappa\ln^2 2}{(x-2)^4}+\frac{320\alpha_0\kappa\ln^2 2}{(x-2)^5}-\frac{640\kappa\ln^2 2}{(x-2)^5}-\frac{640\kappa\ln^2 2}{(x-2)^6}+\frac{160\alpha_0\ln^2 2}{3(x-2)^4}-\frac{160\ln^2 2}{3(x-2)^4}+\frac{320\alpha_0\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3(x-2)^6}+$$

$$\frac{704\alpha_0\kappa\ln 2}{9(x-2)^4}-\frac{704\kappa\ln 2}{9(x-2)^4}+\frac{1408\alpha_0\kappa\ln 2}{9(x-2)^5}-\frac{2816\kappa\ln 2}{9(x-2)^5}-\frac{2816\kappa\ln 2}{9(x-2)^6}+\frac{1088\alpha_0\ln 2}{9(x-2)^4}-\frac{1088\ln 2}{9(x-2)^4}+\frac{2176\alpha_0\ln 2}{9(x-2)^5}-\frac{4352\ln 2}{9(x-2)^5}-$$

$$\frac{4352\ln 2}{9(x-2)^6}\Big)+\frac{25\pi^2x}{216(\kappa+1)}+\frac{242x}{81(\kappa+1)}+\frac{253\pi^2x\kappa}{216(\kappa+1)}-\frac{112\pi^2\kappa}{27(x-2)(\kappa+1)}+\frac{301\pi^2\kappa}{72(x-1)(\kappa+1)}+\frac{140\pi^2\kappa}{27(x-2)^2(\kappa+1)}-\frac{14\pi^2\kappa}{27(x-1)^2(\kappa+1)}-$$

$$\frac{280\pi^2\kappa}{27(x-2)^3(\kappa+1)}-\frac{7\pi^2\kappa}{216(x-1)^3(\kappa+1)}-\frac{8d_1\pi^2\kappa}{3(x-2)^4(\kappa+1)}-\frac{664\pi^2\kappa}{9(x-2)^4(\kappa+1)}-\frac{379\pi^2\kappa}{216(x-1)^4(\kappa+1)}-\frac{32d_1\pi^2\kappa}{3(x-2)^5(\kappa+1)}-$$

$$\frac{512\pi^2\kappa}{3(x-2)^5(\kappa+1)}-\frac{253\pi^2\kappa}{216(x-1)^5(\kappa+1)}-\frac{32d_1\pi^2\kappa}{3(x-2)^6(\kappa+1)}-\frac{416\pi^2\kappa}{9(x-2)^6(\kappa+1)}+\frac{7\pi^2\kappa}{12(\kappa+1)}-\frac{16\pi^2}{27(x-2)(\kappa+1)}+\frac{43\pi^2}{72(x-1)(\kappa+1)}+$$

$$
\frac{20\pi^2}{27(x-2)^2(\kappa+1)} - \frac{2\pi^2}{27(x-1)^2(\kappa+1)} - \frac{40\pi^2}{27(x-2)^3(\kappa+1)} - \frac{\pi^2}{216(x-1)^3(\kappa+1)} - \frac{8d_1\pi^2}{9(x-2)^4(\kappa+1)} - \frac{376\pi^2}{27(x-2)^4(\kappa+1)} -
\frac{23\pi^2}{72(x-1)^4(\kappa+1)} - \frac{32d_1\pi^2}{9(x-2)^5(\kappa+1)} - \frac{1024\pi^2}{27(x-2)^5(\kappa+1)} - \frac{17\pi^2}{72(x-1)^5(\kappa+1)} - \frac{32d_1\pi^2}{9(x-2)^6(\kappa+1)} - \frac{544\pi^2}{27(x-2)^6(\kappa+1)} +
\frac{\pi^2}{12(\kappa+1)} - \frac{x\zeta_3}{\kappa+1} - \frac{7x\kappa\zeta_3}{3(\kappa+1)} + \frac{7\kappa\zeta_3}{3(x-1)^4(\kappa+1)} + \frac{7\kappa\zeta_3}{3(x-1)^5(\kappa+1)} + \frac{\zeta_3}{3(x-1)^4(\kappa+1)} + \frac{\zeta_3}{3(x-1)^5(\kappa+1)} - \frac{1120\kappa\ln^3 2}{9(x-2)^4(\kappa+1)} -
\frac{4480\kappa\ln^3 2}{9(x-2)^5(\kappa+1)} - \frac{4480\kappa\ln^3 2}{9(x-2)^6(\kappa+1)} - \frac{160\ln^3 2}{9(x-2)^4(\kappa+1)} - \frac{640\ln^3 2}{9(x-2)^5(\kappa+1)} - \frac{640\ln^3 2}{9(x-2)^6(\kappa+1)} - \frac{32d_1\kappa\ln^2 2}{(x-2)^4(\kappa+1)} - \frac{416\kappa\ln^2 2}{3(x-2)^4(\kappa+1)} -
\frac{128d_1\kappa\ln^2 2}{(x-2)^5(\kappa+1)} - \frac{1664\kappa\ln^2 2}{3(x-2)^5(\kappa+1)} - \frac{128d_1\kappa\ln^2 2}{(x-2)^6(\kappa+1)} - \frac{1664\kappa\ln^2 2}{3(x-2)^6(\kappa+1)} - \frac{32d_1\ln^2 2}{3(x-2)^4(\kappa+1)} - \frac{544\ln^2 2}{9(x-2)^4(\kappa+1)} - \frac{128d_1\ln^2 2}{3(x-2)^5(\kappa+1)} -
\frac{2176\ln^2 2}{9(x-2)^5(\kappa+1)} - \frac{128d_1\ln^2 2}{3(x-2)^6(\kappa+1)} - \frac{2176\ln^2 2}{9(x-2)^6(\kappa+1)} - \frac{256d_1\kappa\ln 2}{9(x-2)^4(\kappa+1)} - \frac{80\pi^2\kappa\ln 2}{3(x-2)^4(\kappa+1)} - \frac{1856\kappa\ln 2}{27(x-2)^4(\kappa+1)} -
\frac{1024d_1\kappa\ln 2}{9(x-2)^5(\kappa+1)} - \frac{320\pi^2\kappa\ln 2}{3(x-2)^5(\kappa+1)} - \frac{7424\kappa\ln 2}{27(x-2)^5(\kappa+1)} - \frac{1024d_1\kappa\ln 2}{9(x-2)^6(\kappa+1)} - \frac{320\pi^2\kappa\ln 2}{3(x-2)^6(\kappa+1)} - \frac{7424\kappa\ln 2}{27(x-2)^6(\kappa+1)} -
\frac{256d_1\ln 2}{9(x-2)^4(\kappa+1)} - \frac{3392\ln 2}{27(x-2)^4(\kappa+1)} - \frac{1024d_1\ln 2}{9(x-2)^5(\kappa+1)} - \frac{13568\ln 2}{27(x-2)^5(\kappa+1)} - \frac{1024d_1\ln 2}{9(x-2)^6(\kappa+1)} - \frac{13568\ln 2}{27(x-2)^6(\kappa+1)} \Big\}.
$$

D.4 The $\mathcal{A}$ integral for $k = -1$ and $\kappa = 0$

The ε expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;0,2,0,g_A) &= x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;0,2) \\
&= \frac{1}{\varepsilon^2}a_{-2}^{(0,-1)} + \frac{1}{\varepsilon}a_{-1}^{(0,-1)} + a_0^{(0,-1)} + \varepsilon a_1^{(0,-1)} + \varepsilon^2 a_2^{(0,-1)}\mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{D.4}
$$

where

$$a_{-2}^{(0,-1)} = \tfrac{1}{2},$$

$$a_{-1}^{(0,-1)} = -H(0;x),$$

$$
a_0^{(0,-1)} = \frac{\alpha_0^3}{12(x-1)^2} - \frac{\alpha_0^3}{12} + \frac{\alpha_0^2}{24(x-1)} - \frac{5\alpha_0^2}{24(x-1)^2} + \frac{7\alpha_0^2}{24(x-1)^3} + \frac{13\alpha_0^2}{24} - \frac{\alpha_0}{3(x-1)} + \frac{\alpha_0}{6(x-1)^2} - \frac{\alpha_0}{3(x-1)^3} +
\frac{13\alpha_0}{12(x-1)^4} - \frac{23\alpha_0}{12} + \Big(\frac{25}{12} + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5}\Big)H(0;\alpha_0) + \Big(-\frac{25}{12} - \frac{3}{4(x-1)} +
\frac{1}{6(x-1)^2} + \frac{1}{6(x-1)^3} - \frac{3}{4(x-1)^4} - \frac{25}{12(x-1)^5}\Big)H(0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)H(0;\alpha_0)\,H(1;x) + \Big(-\frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} +
\frac{\alpha_0^3}{x-1} - \frac{\alpha_0^3}{3(x-1)^2} - \frac{4\alpha_0^3}{3} - \frac{3\alpha_0^2}{2(x-1)} + \frac{\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{2(x-1)^3} + 3\alpha_0^2 + \frac{\alpha_0}{x-1} - \frac{\alpha_0}{(x-1)^2} + \frac{\alpha_0}{(x-1)^3} - \frac{\alpha_0}{(x-1)^4} - 4\alpha_0 + \frac{3}{4(x-1)} -
\frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big)H(c_1(\alpha_0);x) + 2H(0,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)H(0,c_1(\alpha_0);x) +
\Big(1 - \frac{1}{(x-1)^5}\Big)H(1,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)H(1,c_1(\alpha_0);x) - \frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi^2}{6(x-1)^5} - \frac{\pi^2}{12},
$$

$$
a_1^{(0,-1)} = \frac{7d_1\alpha_0^3}{72} - \frac{7d_1\alpha_0^3}{72(x-1)^2} + \frac{7\alpha_0^3}{72(x-1)^2} - \frac{7\alpha_0^3}{72} - \frac{109d_1\alpha_0^2}{144} - \frac{13d_1\alpha_0^2}{144(x-1)} - \frac{5\alpha_0^2}{144(x-1)} + \frac{29d_1\alpha_0^2}{144(x-1)^2} -
\frac{47\alpha_0^2}{144(x-1)^2} - \frac{67d_1\alpha_0^2}{144(x-1)^3} + \frac{85\alpha_0^2}{144(x-1)^3} + \frac{127\alpha_0^2}{144} + \frac{305d_1\alpha_0}{72} + \frac{19d_1\alpha_0}{18(x-1)} - \frac{2\alpha_0}{9(x-1)} - \frac{d_1\alpha_0}{9(x-1)^2} + \frac{13\alpha_0}{36(x-1)^2} + \frac{d_1\alpha_0}{18(x-1)^3} -
\frac{8\alpha_0}{9(x-1)^3} - \frac{217d_1\alpha_0}{72(x-1)^4} + \frac{149\alpha_0}{36(x-1)^4} - \frac{101\alpha_0}{18} + \Big(-\frac{\alpha_0^3}{6(x-1)^2} + \frac{\alpha_0^3}{6} - \frac{\alpha_0^2}{12(x-1)} + \frac{5\alpha_0^2}{12(x-1)^2} - \frac{7\alpha_0^2}{12(x-1)^3} - \frac{13\alpha_0^2}{12} + \frac{2\alpha_0}{3(x-1)} -
\frac{\alpha_0}{3(x-1)^2} + \frac{2\alpha_0}{3(x-1)^3} - \frac{13\alpha_0}{6(x-1)^4} + \frac{23\alpha_0}{6} - \frac{205d_1}{72} - \frac{15d_1}{8(x-1)} + \frac{1}{4(x-1)} + \frac{5d_1}{18(x-1)^2} - \frac{7}{36(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{13}{36(x-1)^3} -
\frac{15d_1}{8(x-1)^4} + \frac{3}{(x-1)^4} - \frac{205d_1}{72(x-1)^5} + \frac{65}{9(x-1)^5} + \frac{155}{36}\Big)H(0;\alpha_0) + \Big(\frac{15d_1}{8(x-1)} - \frac{5d_1}{18(x-1)^2} - \frac{5d_1}{18(x-1)^3} + \frac{15d_1}{8(x-1)^4} +
\frac{205d_1}{72(x-1)^5} + \frac{205d_1}{72} - \frac{1}{4(x-1)} + \frac{7}{36(x-1)^2} + \frac{13}{36(x-1)^3} - \frac{3}{(x-1)^4} + \frac{\pi^2}{3(x-1)^5} - \frac{65}{9(x-1)^5} + \frac{\pi^2}{6} - \frac{155}{36}\Big)H(0;x) +
\Big(\frac{d_1\alpha_0^3}{6} - \frac{d_1\alpha_0^3}{6(x-1)^2} - \frac{13d_1\alpha_0^2}{12} - \frac{d_1\alpha_0^2}{12(x-1)} + \frac{5d_1\alpha_0^2}{12(x-1)^2} - \frac{7d_1\alpha_0^2}{12(x-1)^3} + \frac{23d_1\alpha_0}{6} + \frac{2d_1\alpha_0}{3(x-1)} - \frac{d_1\alpha_0}{3(x-1)^2} + \frac{2d_1\alpha_0}{3(x-1)^3} -
\frac{13d_1\alpha_0}{6(x-1)^4} - \frac{35d_1}{12} - \frac{7d_1}{12(x-1)} + \frac{d_1}{12(x-1)^2} - \frac{d_1}{12(x-1)^3} + \frac{13d_1}{6(x-1)^4}\Big)H(1;\alpha_0) + \Big(-\frac{d_1\alpha_0^4}{8} + \frac{d_1\alpha_0^4}{8(x-1)} - \frac{\alpha_0^4}{8(x-1)} + \frac{\alpha_0^4}{8} +
\frac{13d_1\alpha_0^3}{18} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{5\alpha_0^3}{6(x-1)} + \frac{2d_1\alpha_0^3}{9(x-1)^2} - \frac{17\alpha_0^3}{36(x-1)^2} - \frac{29\alpha_0^3}{36} - \frac{23d_1\alpha_0^2}{12} + \frac{3d_1\alpha_0^2}{4(x-1)} - \frac{19\alpha_0^2}{8(x-1)} - \frac{2d_1\alpha_0^2}{3(x-1)^2} + \frac{47\alpha_0^2}{24(x-1)^2} +
$$

$$\frac{d_1\alpha_0^2}{2(x-1)^3} - \frac{11\alpha_0^2}{8(x-1)^3} + \frac{59\alpha_0^2}{24} + \frac{25 d_1\alpha_0}{6} - \frac{d_1\alpha_0}{2(x-1)} + \frac{9\alpha_0}{2(x-1)} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{23\alpha_0}{6(x-1)^2} - \frac{d_1\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} -$$

$$\frac{21\alpha_0}{4(x-1)^4} - \frac{73\alpha_0}{12} - \frac{205 d_1}{72} + \Big(\frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{x-1} + \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} + \frac{3\alpha_0^2}{x-1} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} - 6\alpha_0^2 - \frac{2\alpha_0}{x-1} +$$

$$\frac{2\alpha_0}{(x-1)^2} - \frac{2\alpha_0}{(x-1)^3} + \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{3}{2(x-1)} + \frac{1}{3(x-1)^2} + \frac{1}{3(x-1)^3} - \frac{3}{2(x-1)^4} - \frac{25}{6(x-1)^5} - \frac{25}{6}\Big) H(0;\alpha_0) + \Big(-$$

$$\frac{d_1\alpha_0^4}{2} + \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8 d_1\alpha_0^3}{3} - \frac{2d_1\alpha_0^3}{x-1} + \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6 d_1\alpha_0^2 + \frac{3d_1\alpha_0^2}{x-1} - \frac{2d_1\alpha_0^2}{(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} + 8d_1\alpha_0 - \frac{2d_1\alpha_0}{x-1} + \frac{2d_1\alpha_0}{(x-1)^2} -$$

$$\frac{2d_1\alpha_0}{(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5}\Big) H(1;\alpha_0) - \frac{15d_1}{8(x-1)} + \frac{1}{4(x-1)} +$$

$$\frac{5d_1}{18(x-1)^2} - \frac{7}{36(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{13}{36(x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{3}{(x-1)^4} - \frac{205d_1}{72(x-1)^5} + \frac{65}{9(x-1)^5} + \frac{155}{36}\Big) H(c_1(\alpha_0);x) +$$

$$\Big(-\frac{25}{6} - \frac{3}{2(x-1)} + \frac{1}{3(x-1)^2} + \frac{1}{3(x-1)^3} - \frac{3}{2(x-1)^4} - \frac{25}{6(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(\frac{25}{6} + \frac{3}{2(x-1)} - \frac{1}{3(x-1)^2} - \frac{1}{3(x-1)^3} +$$

$$\frac{3}{2(x-1)^4} + \frac{25}{6(x-1)^5}\Big) H(0,0;x) + \Big(-\frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} - \frac{25d_1}{6}\Big) H(0,1;\alpha_0) +$$

$$H(1;x)\Big(-\frac{\pi^2 d_1}{3(x-1)^5} + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} + \frac{5}{4(x-1)} - \frac{5}{6(x-1)^2} + \frac{5}{6(x-1)^3} -$$

$$\frac{5}{4(x-1)^4} + \frac{25}{12(x-1)^5} - \frac{25}{12}\Big) H(0;\alpha_0) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(0,1;\alpha_0) +$$

$$\frac{\pi^2}{6(x-1)^5} + \frac{\pi^2}{6}\Big) + \Big(\frac{2d_1}{(x-1)^5} - 2d_1\Big) H(0;\alpha_0)H(0,1;x) + \Big(-\frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} - \frac{8\alpha_0^3}{3} -$$

$$\frac{3\alpha_0^2}{x-1} + \frac{2\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} + 6\alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} - 8\alpha_0 + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0;\alpha_0) +$$

$$\Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big) H(0,c_1(\alpha_0);x) +$$

$$\Big(-\frac{2d_1}{x-1} + \frac{d_1}{(x-1)^2} - \frac{2d_1}{3(x-1)^3} + \frac{d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} - \frac{5}{4(x-1)} + \frac{5}{6(x-1)^2} - \frac{5}{6(x-1)^3} + \frac{5}{4(x-1)^4} - \frac{25}{12(x-1)^5} +$$

$$\frac{25}{12}\Big) H(1,0;x) + \Big(\frac{4d_1}{(x-1)^5} - 2d_1 - \frac{1}{(x-1)^5} - 1\Big) H(0;\alpha_0)H(1,1;x) + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} +$$

$$\frac{25d_1}{6(x-1)^5} + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{5}{4(x-1)} - \frac{5}{6(x-1)^2} + \frac{5}{6(x-1)^3} - \frac{5}{4(x-1)^4} +$$

$$\frac{25}{12(x-1)^5} - \frac{25}{12}\Big) H(1,c_1(\alpha_0);x) + \Big(\frac{3\alpha_0^4}{4(x-1)} - \frac{3\alpha_0^4}{4} - \frac{3\alpha_0^3}{x-1} + \frac{\alpha_0^3}{(x-1)^2} + 4\alpha_0^3 + \frac{9\alpha_0^2}{2(x-1)} - \frac{3\alpha_0^2}{(x-1)^2} + \frac{3\alpha_0^2}{2(x-1)^3} -$$

$$9\alpha_0^2 - \frac{3\alpha_0}{x-1} + \frac{3\alpha_0}{(x-1)^2} - \frac{3\alpha_0}{(x-1)^3} + \frac{3\alpha_0}{(x-1)^4} + 12\alpha_0 + \frac{2H(0;\alpha_0)}{(x-1)^5} + \frac{2d_1 H(1;\alpha_0)}{(x-1)^5} - \frac{9}{4(x-1)} + \frac{1}{2(x-1)^2} + \frac{1}{2(x-1)^3} -$$

$$\frac{9}{4(x-1)^4} - \frac{25}{4(x-1)^5} - \frac{25}{4}\Big) H(c_1(\alpha_0),c_1(\alpha_0);x) - 4H(0,0,0;x) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(0,1,0;x) + \Big(\frac{2d_1}{(x-1)^5} -$$

$$2d_1\Big) H(0,1,c_1(\alpha_0);x) + \Big(3 - \frac{1}{(x-1)^5}\Big) H(0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{2}{(x-1)^5} - 2\Big) H(1,0,0;x) + \Big(\frac{2d_1}{(x-1)^5} -$$

$$\frac{1}{(x-1)^5} - 1\Big) H(1,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} + 2d_1 + \frac{1}{(x-1)^5} + 1\Big) H(1,1,0;x) + \Big(\frac{4d_1}{(x-1)^5} - 2d_1 - \frac{1}{(x-1)^5} -$$

$$1\Big) H(1,1,c_1(\alpha_0);x) + \Big(-\frac{2d_1}{(x-1)^5} - \frac{1}{(x-1)^5} + 3\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x) - \frac{2H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5} +$$

$$\frac{3H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi^2}{8(x-1)} + \frac{\pi^2}{36(x-1)^2} + \frac{\pi^2}{36(x-1)^3} - \frac{\pi^2}{8(x-1)^4} - \frac{25\pi^2}{72(x-1)^5} - \frac{3\zeta_3}{(x-1)^5} - 5\zeta_3 - \frac{25\pi^2}{72},$$

$$a_2^{(0,-1)} = -\frac{37}{432}d_1^2\alpha_0^3 + \frac{37d_1\alpha_0^3}{216} + \frac{37d_1^2\alpha_0^3}{432(x-1)^2} - \frac{37d_1\alpha_0^3}{216(x-1)^2} - \frac{\pi^2\alpha_0^3}{72(x-1)^2} + \frac{37\alpha_0^3}{432(x-1)^2} + \frac{\pi^2\alpha_0^3}{72} - \frac{37\alpha_0^3}{432} +$$

$$\frac{715d_1^2\alpha_0^2}{864} - \frac{52d_1\alpha_0^2}{27} + \frac{115d_1^2\alpha_0^2}{864(x-1)} + \frac{d_1\alpha_0^2}{216(x-1)} - \frac{\pi^2\alpha_0^2}{144(x-1)} - \frac{119\alpha_0^2}{864(x-1)} - \frac{107d_1^2\alpha_0^2}{864(x-1)^2} + \frac{14d_1\alpha_0^2}{27(x-1)^2} + \frac{5\pi^2\alpha_0^2}{144(x-1)^2} -$$

$$\frac{341\alpha_0^2}{864(x-1)^2} + \frac{493d_1^2\alpha_0^2}{864(x-1)^3} - \frac{305d_1\alpha_0^2}{216(x-1)^3} - \frac{7\pi^2\alpha_0^2}{144(x-1)^3} + \frac{727\alpha_0^2}{864(x-1)^3} - \frac{13\pi^2\alpha_0^2}{144} + \frac{949\alpha_0^2}{864} - \frac{3515d_1^2\alpha_0}{432} + \frac{8965d_1\alpha_0}{432} -$$

$$\frac{265d_1^2\alpha_0}{108(x-1)} + \frac{263d_1\alpha_0}{108(x-1)} + \frac{\pi^2\alpha_0}{18(x-1)} + \frac{65\alpha_0}{108(x-1)} - \frac{d_1^2\alpha_0}{108(x-1)^2} - \frac{113d_1\alpha_0}{216(x-1)^2} - \frac{\pi^2\alpha_0}{36(x-1)^2} + \frac{115\alpha_0}{216(x-1)^2} + \frac{113d_1^2\alpha_0}{108(x-1)^3} +$$

$$\frac{41d_1\alpha_0}{108(x-1)^3} + \frac{\pi^2\alpha_0}{18(x-1)^3} - \frac{217\alpha_0}{108(x-1)^3} + \frac{2911d_1^2\alpha_0}{432(x-1)^4} - \frac{7523d_1\alpha_0}{432(x-1)^4} - \frac{13\pi^2\alpha_0}{72(x-1)^4} + \frac{2369\alpha_0}{216(x-1)^4} + \frac{23\pi^2\alpha_0}{72} - \frac{697\alpha_0}{54} +$$

$$\Big(-\frac{7d_1\alpha_0^3}{36} + \frac{7d_1\alpha_0^3}{36(x-1)^2} - \frac{7\alpha_0^3}{36(x-1)^2} + \frac{7\alpha_0^3}{36} + \frac{109d_1\alpha_0^2}{72} + \frac{13d_1\alpha_0^2}{72(x-1)} + \frac{5\alpha_0^2}{72(x-1)} - \frac{29d_1\alpha_0^2}{72(x-1)^2} + \frac{47\alpha_0^2}{72(x-1)^2} + \frac{67d_1\alpha_0^2}{72(x-1)^3} -$$

$$\frac{85\alpha_0^2}{72(x-1)^3} - \frac{127\alpha_0^2}{72} - \frac{305d_1\alpha_0}{36} - \frac{19d_1\alpha_0}{9(x-1)} + \frac{4\alpha_0}{9(x-1)} + \frac{2d_1\alpha_0}{9(x-1)^2} - \frac{13\alpha_0}{18(x-1)^2} - \frac{d_1\alpha_0}{9(x-1)^3} + \frac{16\alpha_0}{9(x-1)^3} + \frac{217d_1\alpha_0}{36(x-1)^4} -$$

$$\frac{149\alpha_0}{18(x-1)^4} + \frac{101\alpha_0}{9} + \frac{2035d_1^2}{432} - \frac{5615d_1}{432} + \frac{63d_1^2}{16(x-1)} - \frac{209d_1}{48(x-1)} - \frac{\pi^2}{8(x-1)} - \frac{2}{x-1} - \frac{19d_1^2}{54(x-1)^2} + \frac{347d_1}{216(x-1)^2} + \frac{\pi^2}{36(x-1)^2} -$$

$$
\frac{19}{216(x-1)^2} - \frac{19d_1^2}{54(x-1)^3} + \frac{173\ d_1}{216(x-1)^3} + \frac{\pi^2}{36(x-1)^3} - \frac{205}{216\ (x-1)^3} + \frac{63d_1^2}{16(x-1)^4} - \frac{197d_1}{16\ (x-1)^4} - \frac{\pi^2}{8(x-1)^4} + \frac{163}{24(x-1)^4} +
$$

$$
\frac{2035\ d_1^2}{432(x-1)^5} - \frac{8705d_1}{432(x-1)^5} - \frac{25\pi^2}{72\ (x-1)^5} + \frac{3965}{216(x-1)^5} - \frac{25\pi^2}{72} + \frac{235}{27} \Big) H(0;\alpha_0) + \Big(- \frac{7}{36} d_1^2 \alpha_0^3 + \frac{7d_1\alpha_0^3}{36} + \frac{7d_1^2\alpha_0^3}{36(x-1)^2} -
$$

$$
\frac{7d_1\alpha_0^3}{36\ (x-1)^2} + \frac{109d_1^2\alpha_0^2}{72} - \frac{127d_1\alpha_0^2}{72} + \frac{13\ d_1^2\alpha_0^2}{72(x-1)} + \frac{5d_1\alpha_0^2}{72(x-1)} - \frac{29d_1^2\ \alpha_0^2}{72(x-1)^2} + \frac{47d_1\alpha_0^2}{72(x-1)^2} + \frac{67d_1^2\ \alpha_0^2}{72(x-1)^3} - \frac{85d_1\alpha_0^2}{72(x-1)^3} - \frac{305d_1^2\ \alpha_0}{36} +
$$

$$
\frac{101d_1\alpha_0}{9} - \frac{19d_1^2\alpha_0}{9(x-1)} + \frac{4\ d_1\alpha_0}{9(x-1)} + \frac{2d_1^2\alpha_0}{9(x-1)^2} - \frac{13d_1\alpha_0}{18\ (x-1)^2} - \frac{d_1^2\alpha_0}{9(x-1)^3} + \frac{16d_1\alpha_0}{9\ (x-1)^3} + \frac{217d_1^2\alpha_0}{36(x-1)^4} - \frac{149d_1\alpha_0}{18\ (x-1)^4} + \frac{515d_1^2}{72} -
$$

$$
\frac{695d_1}{72} + \frac{139d_1^2}{72\ (x-1)} - \frac{37d_1}{72(x-1)} - \frac{d_1^2}{72(x-1)^2} + \frac{19\ d_1}{72(x-1)^2} - \frac{59d_1^2}{72(x-1)^3} - \frac{43d_1}{72\ (x-1)^3} - \frac{217d_1^2}{36(x-1)^4} + \frac{149d_1}{18(x-1)^4} \Big) H(1;\alpha_0) +
$$

$$
\Big(\frac{\alpha_0^3}{3(x-1)^2} - \frac{\alpha_0^3}{3} + \frac{\alpha_0^2}{6\ (x-1)} - \frac{5\alpha_0^2}{6(x-1)^2} + \frac{7\alpha_0^2}{6(x-1)^3} + \frac{13\ \alpha_0^2}{6} - \frac{4\alpha_0}{3(x-1)} + \frac{2\alpha_0}{3(x-1)^2} - \frac{4\ \alpha_0}{3(x-1)^3} + \frac{13\alpha_0}{3(x-1)^4} - \frac{23\alpha_0}{3} + \frac{205\ d_1}{36} +
$$

$$
\frac{15d_1}{4(x-1)} - \frac{1}{2(x-1)} - \frac{5d_1}{9\ (x-1)^2} + \frac{7}{18(x-1)^2} - \frac{5d_1}{9(x-1)^3} + \frac{13}{18\ (x-1)^3} + \frac{15d_1}{4(x-1)^4} - \frac{6}{(x-1)^4} + \frac{205d_1}{36\ (x-1)^5} - \frac{130}{9(x-1)^5} -
$$

$$
\frac{155}{18} \Big) H(0,0;\alpha_0) + \Big(- \frac{15d_1}{4(x-1)} + \frac{5d_1}{9\ (x-1)^2} + \frac{5d_1}{9(x-1)^3} - \frac{15d_1}{4(x-1)^4} - \frac{205\ d_1}{36(x-1)^5} - \frac{205d_1}{36} + \frac{1}{2(x-1)} - \frac{7}{18\ (x-1)^2} -
$$

$$
\frac{13}{18(x-1)^3} + \frac{6}{(x-1)^4} - \frac{2\pi^2}{3\ (x-1)^5} + \frac{130}{9(x-1)^5} - \frac{\pi^2}{3} + \frac{155}{18} \Big) H(0,0;x) + \Big(- \frac{d_1\alpha_0^3}{3} + \frac{d_1\alpha_0^3}{3\ (x-1)^2} + \frac{13d_1\alpha_0^2}{6} + \frac{d_1\alpha_0^2}{6(x-1)} -
$$

$$
\frac{5d_1\ \alpha_0^2}{6(x-1)^2} + \frac{7d_1\alpha_0^2}{6(x-1)^3} - \frac{23d_1\alpha_0}{3} - \frac{4d_1\alpha_0}{3(x-1)} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{4d_1\ \alpha_0}{3(x-1)^3} + \frac{13d_1\alpha_0}{3(x-1)^4} + \frac{205\ d_1^2}{36} - \frac{155d_1}{18} + \frac{15d_1^2}{4(x-1)} - \frac{d_1}{2\ (x-1)} -
$$

$$
\frac{5d_1^2}{9(x-1)^2} + \frac{7d_1}{18(x-1)^2} - \frac{5\ d_1^2}{9(x-1)^3} + \frac{13d_1}{18(x-1)^3} + \frac{15d_1^2}{4\ (x-1)^4} - \frac{6d_1}{(x-1)^4} + \frac{205d_1^2}{36(x-1)^5} - \frac{130\ d_1}{9(x-1)^5} \Big) H(0,1;\alpha_0) + \Big(\frac{\pi^2 d_1}{3\ (x-1)^5} +
$$

$$
\frac{\pi^2 d_1}{3} + \Big(\frac{5d_1}{2(x-1)} - \frac{5\ d_1}{3(x-1)^2} + \frac{5d_1}{3(x-1)^3} - \frac{5d_1}{2\ (x-1)^4} + \frac{25d_1}{6(x-1)^5} - \frac{25d_1}{6} + \frac{5}{2(x-1)} - \frac{5}{3(x-1)^2} + \frac{5}{3(x-1)^3} - \frac{5}{2\ (x-1)^4} +
$$

$$
\frac{25}{6(x-1)^5} - \frac{25}{6} \Big) H(0;\alpha_0) + \Big(4\ d_1 - \frac{4d_1}{(x-1)^5} \Big) H(0,0;\alpha_0) + \Big(4d_1^2 - \frac{4\ d_1^2}{(x-1)^5} \Big) H(0,1;\alpha_0) - \frac{2\pi^2}{3(x-1)^5} \Big) H(0,1;x) +
$$

$$
\Big(- \frac{d_1\alpha_0^3}{3} + \frac{d_1\alpha_0^3}{3\ (x-1)^2} + \frac{13d_1\alpha_0^2}{6} + \frac{d_1\alpha_0^2}{6(x-1)} - \frac{5d_1\ \alpha_0^2}{6(x-1)^2} + \frac{7d_1\alpha_0^2}{6(x-1)^3} - \frac{23d_1\alpha_0}{3} - \frac{4d_1\alpha_0}{3(x-1)} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{4d_1\ \alpha_0}{3(x-1)^3} + \frac{13d_1\alpha_0}{3(x-1)^4} +
$$

$$
\frac{35d_1}{6} + \frac{7\ d_1}{6(x-1)} - \frac{d_1}{6(x-1)^2} + \frac{d_1}{6(x-1)^3} - \frac{13\ d_1}{3(x-1)^4} \Big) H(1,0;\alpha_0) + \Big(\frac{4\ d_1^2}{x-1} - \frac{d_1^2}{(x-1)^2} + \frac{4d_1^2}{9\ (x-1)^3} - \frac{d_1^2}{4(x-1)^4} + \frac{205d_1^2}{36\ (x-1)^5} -
$$

$$
\frac{97d_1}{24(x-1)} + \frac{157d_1}{36(x-1)^2} - \frac{137\ d_1}{36(x-1)^3} + \frac{19d_1}{8(x-1)^4} + \frac{2\pi^2 d_1}{3\ (x-1)^5} - \frac{835d_1}{72(x-1)^5} - \frac{205d_1}{72} - \frac{97}{12\ (x-1)} + \frac{179}{36(x-1)^2} - \frac{179}{36(x-1)^3} +
$$

$$
\frac{97}{12\ (x-1)^4} - \frac{\pi^2}{6(x-1)^5} - \frac{155}{36(x-1)^5} - \frac{\pi^{\ 2}}{2} + \frac{155}{36} \Big) H(1,0;x) + \Big(- \frac{1}{3} d_1^2\ \alpha_0^3 + \frac{d_1^2\alpha_0^3}{3(x-1)^2} + \frac{13d_1^2\ \alpha_0^2}{6} + \frac{d_1^2\alpha_0^2}{6(x-1)} -
$$

$$
\frac{5d_1^2\alpha_0^2}{6\ (x-1)^2} + \frac{7d_1^2\alpha_0^2}{6(x-1)^3} - \frac{23d_1^2\ \alpha_0}{3} - \frac{4d_1^2\alpha_0}{3(x-1)} + \frac{2d_1^2\alpha_0}{3\ (x-1)^2} - \frac{4d_1^2\alpha_0}{3(x-1)^3} + \frac{13d_1^2\alpha_0}{3\ (x-1)^4} + \frac{35d_1^2}{6} + \frac{7d_1^2}{6(x-1)} - \frac{d_1^2}{6\ (x-1)^2} + \frac{d_1^2}{6(x-1)^3} -
$$

$$
\frac{13d_1^2}{3(x-1)^4} \Big) H(1,1;\alpha_0) + H(0,c_1(\alpha_0);x) \Big(- \frac{d_1\alpha_0^4}{4} + \frac{d_1\ \alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} + \frac{13d_1\ \alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{5\alpha_0^3}{3(x-1)} + \frac{4d_1\ \alpha_0^3}{9(x-1)^2} -
$$

$$
\frac{7\alpha_0^3}{9(x-1)^2} - \frac{16\ \alpha_0^3}{9} - \frac{23d_1\alpha_0^2}{6} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{14\ \alpha_0^2}{3(x-1)} - \frac{4d_1\alpha_0^2}{3(x-1)^2} + \frac{7\alpha_0^2}{2\ (x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{13\alpha_0^2}{6(x-1)^3} + 6\ \alpha_0^2 + \frac{25d_1\alpha_0}{3} - \frac{d_1\alpha_0}{x-1} +
$$

$$
\frac{25\alpha_0}{3\ (x-1)} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{22\alpha_0}{3(x-1)^2} - \frac{2\ d_1\alpha_0}{(x-1)^3} + \frac{22\alpha_0}{3(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{25\alpha_0}{3(x-1)^4} - 16\alpha_0 - \frac{205\ d_1}{72} + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} +
$$

$$
\frac{4\ \alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\ \alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\ \alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\ \alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{3}{2(x-1)} + \frac{1}{3(x-1)^2} +
$$

$$
\frac{1}{3\ (x-1)^3} - \frac{3}{2(x-1)^4} - \frac{25}{6(x-1)^5} - \frac{25}{6} \Big) H(0;\alpha_0) + \Big(- d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} + \frac{16d_1\ \alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} - 12\ d_1\alpha_0^2 +
$$

$$
\frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2\ d_1\alpha_0^2}{(x-1)^3} + 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\ \alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\ \alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{3d_1}{2(x-1)} + \frac{d_1}{3\ (x-1)^2} + \frac{d_1}{3(x-1)^3} -
$$

$$
\frac{3d_1}{2(x-1)^4} - \frac{25\ d_1}{6(x-1)^5} \Big) H(1;\alpha_0) + \Big(\frac{4}{(x-1)^5} - 4 \Big) H(0,0;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 \Big) H(0,1;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} -
$$

$$
4d_1 \Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2 \Big) H(1,1;\alpha_0) - \frac{15d_1}{8(x-1)} + \frac{3}{x-1} + \frac{5d_1}{18\ (x-1)^2} - \frac{13}{36(x-1)^2} + \frac{5d_1}{18(x-1)^3} -
$$

$$
\frac{7}{36\ (x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{1}{4(x-1)^4} - \frac{205\ d_1}{72(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{155}{36\ (x-1)^5} + \frac{\pi^2}{6} + \frac{65}{9} \Big) + H(c_1(\alpha_0);x) \Big(\frac{d_1^2\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{8} -
$$

$$
\frac{d_1^2\alpha_0^4}{16\ (x-1)} + \frac{d_1\alpha_0^4}{8(x-1)} + \frac{\pi^2\alpha_0^4}{24(x-1)} - \frac{\alpha_0^4}{16(x-1)} - \frac{\pi^2\alpha_0^4}{24} + \frac{\alpha_0^4}{16} - \frac{43\ d_1^2\alpha_0^3}{108} + \frac{193d_1\alpha_0^3}{216} + \frac{d_1^2\alpha_0^3}{4\ (x-1)} - \frac{8d_1\alpha_0^3}{9(x-1)} - \frac{\pi^2\alpha_0^3}{6\ (x-1)} + \frac{23\alpha_0^3}{36(x-1)} -
$$

$$
\frac{4d_1^2\alpha_0^3}{27\ (x-1)^2} + \frac{127d_1\alpha_0^3}{216(x-1)^2} + \frac{\pi^2\alpha_0^3}{18\ (x-1)^2} - \frac{95\alpha_0^3}{216(x-1)^2} + \frac{2\pi^2\ \alpha_0^3}{9} - \frac{107\alpha_0^3}{216} + \frac{95d_1^2\alpha_0^2}{72} - \frac{163\ d_1\alpha_0^2}{48} - \frac{3d_1^2\alpha_0^2}{8(x-1)} + \frac{47d_1\alpha_0^2}{16\ (x-1)} +
$$

$$
\frac{\pi^2\alpha_0^2}{4(x-1)} - \frac{47\alpha_0^2}{16(x-1)} + \frac{4\ d_1^2\alpha_0^2}{9(x-1)^2} - \frac{125d_1\alpha_0^2}{48(x-1)^2} - \frac{\pi^2\ \alpha_0^2}{6(x-1)^2} + \frac{401\alpha_0^2}{144(x-1)^2} - \frac{d_1^2\alpha_0^2}{2\ (x-1)^3} + \frac{115d_1\alpha_0^2}{48(x-1)^3} + \frac{\pi^2\alpha_0^2}{12\ (x-1)^3} - \frac{35\alpha_0^2}{16(x-1)^3} -
$$

$$
\frac{\pi^2\alpha_0^2}{2} + \frac{305\ \alpha_0^2}{144} - \frac{205d_1^2\alpha_0}{36} + \frac{125d_1\ \alpha_0}{8} + \frac{d_1^2\alpha_0}{4(x-1)} - \frac{53d_1\alpha_0}{6\ (x-1)} - \frac{\pi^2\alpha_0}{6(x-1)} + \frac{47\alpha_0}{4(x-1)} - \frac{4\ d_1^2\alpha_0}{9(x-1)^2} + \frac{7d_1\alpha_0}{(x-1)^2} + \frac{\pi^2\alpha_0}{6\ (x-1)^2} -
$$

$$
\frac{389\alpha_0}{36(x-1)^2} + \frac{d_1^2\ \alpha_0}{(x-1)^3} - \frac{49d_1\alpha_0}{6(x-1)^3} - \frac{\pi^2\alpha_0}{6\ (x-1)^3} + \frac{34\alpha_0}{3(x-1)^3} - \frac{4d_1^2\ \alpha_0}{(x-1)^4} + \frac{409d_1\alpha_0}{24(x-1)^4} + \frac{\pi^2\alpha_0}{6\ (x-1)^4} - \frac{47\alpha_0}{3(x-1)^4} + \frac{2\pi^2\alpha_0}{3} - \frac{187\ \alpha_0}{18} +
$$

$$\frac{2035d_1^2}{432} - \frac{5615d_1}{432} + \Big(\frac{d_1\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{4} - \frac{13d_1\alpha_0^3}{9} + \frac{d_1\alpha_0^3}{x-1} - \frac{5\alpha_0^3}{3(x-1)} - \frac{4d_1\alpha_0^3}{9(x-1)^2} + \frac{17\alpha_0^3}{18(x-1)^2} + \frac{29\alpha_0^3}{18} +$$
$$\frac{23d_1\alpha_0^2}{6} - \frac{3d_1\alpha_0^2}{2(x-1)} + \frac{19\alpha_0^2}{4(x-1)} + \frac{4d_1\alpha_0^2}{3(x-1)^2} - \frac{47\alpha_0^2}{12(x-1)^2} - \frac{d_1\alpha_0^2}{(x-1)^3} + \frac{11\alpha_0^2}{4(x-1)^3} - \frac{59\alpha_0^2}{12} - \frac{25d_1\alpha_0}{3} + \frac{d_1\alpha_0}{x-1} - \frac{9\alpha_0}{x-1} - \frac{4d_1\alpha_0}{3(x-1)^2} +$$
$$\frac{23\alpha_0}{3(x-1)^2} + \frac{2d_1\alpha_0}{(x-1)^3} - \frac{8\alpha_0}{(x-1)^3} - \frac{4d_1\alpha_0}{(x-1)^4} + \frac{21\alpha_0}{2(x-1)^4} + \frac{73\alpha_0}{6} + \frac{205d_1}{36} + \frac{15d_1}{4(x-1)} - \frac{1}{2(x-1)} - \frac{5d_1}{9(x-1)^2} + \frac{7}{18(x-1)^2} -$$
$$\frac{5d_1}{9(x-1)^3} + \frac{13}{18(x-1)^3} + \frac{15d_1}{4(x-1)^4} - \frac{6}{(x-1)^4} + \frac{205d_1}{36(x-1)^5} - \frac{130}{9(x-1)^5} - \frac{155}{18} \Big) H(0;\alpha_0) + \Big(\frac{d_1^2\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{4} - \frac{d_1^2\alpha_0^4}{4(x-1)} +$$
$$\frac{d_1\alpha_0^4}{4(x-1)} - \frac{13d_1^2\alpha_0^3}{9} + \frac{29d_1\alpha_0^3}{18} + \frac{d_1^2\alpha_0^3}{x-1} - \frac{5d_1\alpha_0^3}{3(x-1)} - \frac{4d_1^2\alpha_0^3}{9(x-1)^2} + \frac{17d_1\alpha_0^3}{18(x-1)^2} + \frac{23d_1^2\alpha_0^2}{6} - \frac{59d_1\alpha_0^2}{12} - \frac{3d_1^2\alpha_0^2}{2(x-1)} + \frac{19d_1\alpha_0^2}{4(x-1)} +$$
$$\frac{4d_1^2\alpha_0^2}{3(x-1)^2} - \frac{47d_1\alpha_0^2}{12(x-1)^2} - \frac{d_1^2\alpha_0^2}{(x-1)^3} + \frac{11d_1\alpha_0^2}{4(x-1)^3} - \frac{25d_1^2\alpha_0}{3} + \frac{73d_1\alpha_0}{6} + \frac{d_1^2\alpha_0}{x-1} - \frac{9d_1\alpha_0}{x-1} - \frac{4d_1^2\alpha_0}{3(x-1)^2} + \frac{23d_1\alpha_0}{3(x-1)^2} + \frac{2d_1^2\alpha_0}{(x-1)^3} -$$
$$\frac{8d_1\alpha_0}{(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{21d_1\alpha_0}{2(x-1)^4} + \frac{205d_1^2}{36} - \frac{155d_1}{18} + \frac{15d_1^2}{4(x-1)} - \frac{d_1}{2(x-1)} - \frac{5d_1^2}{9(x-1)^2} + \frac{7d_1}{18(x-1)^2} - \frac{5d_1^2}{9(x-1)^3} + \frac{13d_1}{18(x-1)^3} +$$
$$\frac{15d_1^2}{4(x-1)^4} - \frac{6d_1}{(x-1)^4} + \frac{205d_1^2}{36(x-1)^5} - \frac{130d_1}{9(x-1)^5} \Big) H(1;\alpha_0) + \Big(-\frac{\alpha_0^4}{x-1} + \alpha_0^4 + \frac{4\alpha_0^3}{x-1} - \frac{4\alpha_0^3}{3(x-1)^2} - \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-1} + \frac{4\alpha_0^2}{(x-1)^2} -$$
$$\frac{2\alpha_0^2}{(x-1)^3} + 12\alpha_0^2 + \frac{4\alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\alpha_0}{(x-1)^4} - 16\alpha_0 + \frac{3}{x-1} - \frac{2}{3(x-1)^2} - \frac{2}{3(x-1)^3} + \frac{3}{(x-1)^4} + \frac{25}{3(x-1)^5} +$$
$$\frac{25}{3} \Big) H(0,0;\alpha_0) + \Big(d_1\alpha_0^4 - \frac{d_1\alpha_0^4}{x-1} - \frac{16d_1\alpha_0^3}{3} + \frac{4d_1\alpha_0^3}{x-1} - \frac{4d_1\alpha_0^3}{3(x-1)^2} + 12d_1\alpha_0^2 - \frac{6d_1\alpha_0^2}{x-1} + \frac{4d_1\alpha_0^2}{(x-1)^2} - \frac{2d_1\alpha_0^2}{(x-1)^3} - 16d_1\alpha_0 +$$
$$\frac{4d_1\alpha_0}{x-1} - \frac{4d_1\alpha_0}{(x-1)^2} + \frac{4d_1\alpha_0}{(x-1)^3} - \frac{4d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{3} + \frac{3d_1}{x-1} - \frac{2d_1}{3(x-1)^2} - \frac{2d_1}{3(x-1)^3} + \frac{3d_1}{(x-1)^4} + \frac{25d_1}{3(x-1)^5} \Big) H(0,1;\alpha_0) +$$
$$\Big(d_1\alpha_0^4 - \frac{d_1\alpha_0^4}{x-1} - \frac{16d_1\alpha_0^3}{3} + \frac{4d_1\alpha_0^3}{x-1} - \frac{4d_1\alpha_0^3}{3(x-1)^2} + 12d_1\alpha_0^2 - \frac{6d_1\alpha_0^2}{x-1} + \frac{4d_1\alpha_0^2}{(x-1)^2} - \frac{2d_1\alpha_0^2}{(x-1)^3} - 16d_1\alpha_0 + \frac{4d_1\alpha_0}{x-1} - \frac{4d_1\alpha_0}{(x-1)^2} +$$
$$\frac{4d_1\alpha_0}{(x-1)^3} - \frac{4d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{3} + \frac{3d_1}{x-1} - \frac{2d_1}{3(x-1)^2} - \frac{2d_1}{3(x-1)^3} + \frac{3d_1}{(x-1)^4} + \frac{25d_1}{3(x-1)^5} \Big) H(1,0;\alpha_0) + \Big(d_1^2\alpha_0^4 - \frac{d_1^2\alpha_0^4}{x-1} -$$
$$\frac{16d_1^2\alpha_0^3}{3} + \frac{4d_1^2\alpha_0^3}{x-1} - \frac{4d_1^2\alpha_0^3}{3(x-1)^2} + 12d_1^2\alpha_0^2 - \frac{6d_1^2\alpha_0^2}{x-1} + \frac{4d_1^2\alpha_0^2}{(x-1)^2} - \frac{2d_1^2\alpha_0^2}{(x-1)^3} - 16d_1^2\alpha_0 + \frac{4d_1^2\alpha_0}{x-1} - \frac{4d_1^2\alpha_0}{(x-1)^2} + \frac{4d_1^2\alpha_0}{(x-1)^3} -$$
$$\frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{25d_1^2}{3} + \frac{3d_1^2}{x-1} - \frac{2d_1^2}{3(x-1)^2} - \frac{2d_1^2}{3(x-1)^3} + \frac{3d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} \Big) H(1,1;\alpha_0) + \frac{63d_1^2}{16(x-1)} - \frac{209d_1}{48(x-1)} - \frac{\pi^2}{8(x-1)} -$$
$$\frac{2}{x-1} - \frac{19d_1^2}{54(x-1)^2} + \frac{347d_1}{216(x-1)^2} + \frac{\pi^2}{36(x-1)^2} - \frac{19}{216(x-1)^2} - \frac{19d_1^2}{54(x-1)^3} + \frac{173d_1}{216(x-1)^3} + \frac{\pi^2}{36(x-1)^3} - \frac{205}{216(x-1)^3} +$$
$$\frac{63d_1^2}{16(x-1)^4} - \frac{197d_1}{16(x-1)^4} - \frac{\pi^2}{8(x-1)^4} + \frac{163}{24(x-1)^4} + \frac{2035d_1^2}{432(x-1)^5} - \frac{8705d_1}{432(x-1)^5} - \frac{25\pi^2}{72(x-1)^5} + \frac{3965}{216(x-1)^5} - \frac{25\pi^2}{72} + \frac{235}{27} \Big) +$$
$$\Big(-\frac{2\pi^2d_1^2}{3(x-1)^5} + \frac{2\pi^2d_1}{3(x-1)^5} + \frac{\pi^2d_1}{3} + \Big(\frac{4d_1^2}{x-1} - \frac{2d_1^2}{(x-1)^2} + \frac{4d_1^2}{3(x-1)^3} - \frac{d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} + \frac{9d_1}{2(x-1)} - \frac{8d_1}{3(x-1)^2} + \frac{7d_1}{3(x-1)^3} -$$
$$\frac{3d_1}{(x-1)^4} + \frac{25d_1}{3(x-1)^5} - \frac{25d_1}{6} - \frac{1}{4(x-1)} - \frac{1}{2(x-1)^2} + \frac{7}{6(x-1)^3} - \frac{11}{4(x-1)^4} - \frac{25}{12(x-1)^5} - \frac{25}{4} \Big) H(0;\alpha_0) + \Big(-\frac{8d_1}{(x-1)^5} +$$
$$4d_1 + \frac{2}{(x-1)^5} + 2 \Big) H(0,0;\alpha_0) + \Big(-\frac{8d_1^2}{(x-1)^5} + 4d_1^2 + \frac{2d_1}{(x-1)^5} + 2d_1 \Big) H(0,1;\alpha_0) - \frac{\pi^2}{6(x-1)^5} - \frac{\pi^2}{6} \Big) H(1,1;x) +$$
$$\Big(-\frac{4d_1^2}{x-1} + \frac{d_1^2}{(x-1)^2} - \frac{4d_1^2}{9(x-1)^3} + \frac{d_1^2}{4(x-1)^4} - \frac{205d_1^2}{36(x-1)^5} + \frac{97d_1}{24(x-1)} - \frac{157d_1}{36(x-1)^2} + \frac{137d_1}{36(x-1)^3} - \frac{19d_1}{8(x-1)^4} + \frac{835d_1}{72(x-1)^5} +$$
$$\frac{205d_1}{72} + \Big(-\frac{4d_1}{x-1} + \frac{2d_1}{(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{d_1}{(x-1)^4} - \frac{25d_1}{3(x-1)^5} - \frac{5}{2(x-1)} + \frac{5}{3(x-1)^2} - \frac{5}{3(x-1)^3} + \frac{5}{2(x-1)^4} - \frac{25}{6(x-1)^5} +$$
$$\frac{25}{6} \Big) H(0;\alpha_0) + \Big(-\frac{4d_1^2}{x-1} + \frac{2d_1^2}{(x-1)^2} - \frac{4d_1^2}{3(x-1)^3} + \frac{d_1^2}{(x-1)^4} - \frac{25d_1^2}{3(x-1)^5} - \frac{5d_1}{2(x-1)} + \frac{5d_1}{3(x-1)^2} - \frac{5d_1}{3(x-1)^3} + \frac{5d_1}{2(x-1)^4} -$$
$$\frac{25d_1}{6(x-1)^5} + \frac{25d_1}{6} \Big) H(1;\alpha_0) + \Big(\frac{4}{(x-1)^5} - 4 \Big) H(0,0;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} - 4d_1 \Big) H(0,1;\alpha_0) + \Big(\frac{4d_1}{(x-1)^5} -$$
$$4d_1 \Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2 \Big) H(1,1;\alpha_0) + \frac{97}{12(x-1)} - \frac{179}{36(x-1)^2} + \frac{179}{36(x-1)^3} - \frac{97}{12(x-1)^4} - \frac{\pi^2}{6(x-1)^5} +$$
$$\frac{155}{36(x-1)^5} + \frac{\pi^2}{6} - \frac{155}{36} \Big) H(1,c_1(\alpha_0);x) + \Big(\frac{3d_1\alpha_0^4}{8} - \frac{3d_1\alpha_0^4}{8(x-1)} + \frac{3\alpha_0^4}{8(x-1)} - \frac{3\alpha_0^4}{8} - \frac{13d_1\alpha_0^3}{6} + \frac{3d_1\alpha_0^3}{2(x-1)} - \frac{5\alpha_0^3}{2(x-1)} -$$
$$\frac{2d_1\alpha_0^3}{3(x-1)^2} + \frac{5\alpha_0^3}{4(x-1)^2} + \frac{31\alpha_0^3}{12} + \frac{23d_1\alpha_0^2}{4} - \frac{9d_1\alpha_0^2}{4(x-1)} + \frac{169\alpha_0^2}{24(x-1)} + \frac{2d_1\alpha_0^2}{(x-1)^2} - \frac{131\alpha_0^2}{24(x-1)^2} - \frac{3d_1\alpha_0^2}{2(x-1)^3} + \frac{85\alpha_0^2}{24(x-1)^3} - \frac{203\alpha_0^2}{24} -$$
$$\frac{25d_1\alpha_0}{2} + \frac{3d_1\alpha_0}{2(x-1)} - \frac{77\alpha_0}{6(x-1)} - \frac{2d_1\alpha_0}{(x-1)^2} + \frac{67\alpha_0}{6(x-1)^2} + \frac{3d_1\alpha_0}{(x-1)^3} - \frac{34\alpha_0}{3(x-1)^3} - \frac{6d_1\alpha_0}{(x-1)^4} + \frac{163\alpha_0}{12(x-1)^4} + \frac{265\alpha_0}{12} + \frac{205d_1}{24} + \Big(-$$
$$\frac{3\alpha_0^4}{2(x-1)} + \frac{3\alpha_0^4}{2} + \frac{6\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{(x-1)^2} - 8\alpha_0^3 - \frac{9\alpha_0^2}{x-1} + \frac{6\alpha_0^2}{(x-1)^2} - \frac{3\alpha_0^2}{(x-1)^3} + 18\alpha_0^2 + \frac{6\alpha_0}{x-1} - \frac{6\alpha_0}{(x-1)^2} + \frac{6\alpha_0}{(x-1)^3} - \frac{6\alpha_0}{(x-1)^4} -$$
$$24\alpha_0 + \frac{9}{2(x-1)} - \frac{1}{(x-1)^2} - \frac{1}{(x-1)^3} + \frac{9}{2(x-1)^4} + \frac{25}{2(x-1)^5} + \frac{25}{2} \Big) H(0;\alpha_0) + \Big(\frac{3d_1\alpha_0^4}{2} - \frac{3d_1\alpha_0^4}{2(x-1)} - 8d_1\alpha_0^3 + \frac{6d_1\alpha_0^3}{x-1} -$$
$$\frac{2d_1\alpha_0^3}{(x-1)^2} + 18d_1\alpha_0^2 - \frac{9d_1\alpha_0^2}{x-1} + \frac{6d_1\alpha_0^2}{(x-1)^2} - \frac{3d_1\alpha_0^2}{(x-1)^3} - 24d_1\alpha_0 + \frac{6d_1\alpha_0}{x-1} - \frac{6d_1\alpha_0}{(x-1)^2} + \frac{6d_1\alpha_0}{(x-1)^3} - \frac{6d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{2} + \frac{9d_1}{2(x-1)} -$$

$$\frac{d_1}{(x-1)^2}-\frac{d_1}{(x-1)^3}+\frac{9d_1}{2\ (x-1)^4}+\frac{25d_1}{2(x-1)^5}\Big)H(1;\alpha_0)-\frac{4\ H(0,0;\alpha_0)}{(x-1)^5}-\frac{4d_1 H(0,1;\alpha_0)}{(x-1)^5}-\frac{4d_1\ H(1,0;\alpha_0)}{(x-1)^5}-\frac{4d_1^2 H(1,1;\alpha_0)}{(x-1)^5}+$$

$$\frac{45\ d_1}{8(x-1)}-\frac{7}{2(x-1)}-\frac{5d_1}{6(x-1)^2}+\frac{3}{4\ (x-1)^2}-\frac{5d_1}{6(x-1)^3}+\frac{11}{12(x-1)^3}+\frac{45\ d_1}{8(x-1)^4}-\frac{25}{4(x-1)^4}+\frac{205d_1}{24\ (x-1)^5}+\frac{\pi^2}{6(x-1)^5}-$$

$$\frac{75}{4\ (x-1)^5}-\frac{95}{6}\Big)\ H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{25}{3}+\frac{3}{x-1}-\frac{2}{3\ (x-1)^2}-\frac{2}{3(x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3\ (x-1)^5}\Big)\ H(0,0,0;\alpha_0)+$$

$$\Big(-\frac{25}{3}-\frac{3}{x-1}+\frac{2}{3\ (x-1)^2}+\frac{2}{3(x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3\ (x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{3d_1}{x-1}-\frac{2d_1}{3\ (x-1)^2}-\frac{2d_1}{3(x-1)^3}+$$

$$\frac{3d_1}{(x-1)^4}+\frac{25\ d_1}{3(x-1)^5}+\frac{25d_1}{3}\Big)\ H(0,0,1;\alpha_0)+\Big(\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)H(0,0,1;x)+\Big(-\ \frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-1}-$$

$$\frac{4\alpha_0^3}{3\ (x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\ \alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\ \alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\ \alpha_0}{(x-1)^4}-16\alpha_0+\frac{3}{2(x-1)}-$$

$$\frac{1}{3(x-1)^2}-\frac{1}{3\ (x-1)^3}+\frac{3}{2(x-1)^4}+\frac{25}{6(x-1)^5}+\frac{25}{6}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(\frac{3d_1}{x-1}-\frac{2d_1}{3\ (x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+$$

$$\frac{25\ d_1}{3(x-1)^5}+\frac{25d_1}{3}\Big)H(0,1,0;\alpha_0)+\Big(-\frac{5\ d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3(x-1)^3}+\frac{5\ d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25d_1}{6}-\frac{5}{2\ (x-1)}+$$

$$\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2\ (x-1)^4}-\frac{25}{6(x-1)^5}+\frac{25}{6}\Big)\ H(0,1,0;x)+\Big(\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2\ d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+$$

$$\frac{25d_1^2}{3}\Big)H(0,1,1;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4\ d_1^2-\frac{2d_1}{(x-1)^5}-2d_1+\frac{4}{(x-1)^5}\Big)H(0;\alpha_0)\ H(0,1,1;x)+\Big(\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+$$

$$\frac{5\ d_1}{3(x-1)^3}-\frac{5d_1}{2(x-1)^4}+\frac{25d_1}{6\ (x-1)^5}-\frac{25d_1}{6}+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)\ H(0;\alpha_0)+\Big(4d_1^2-\frac{4d_1^2}{(x-1)^5}\Big)\ H(1;\alpha_0)+\frac{5}{2(x-1)}-$$

$$\frac{5}{3(x-1)^2}+\frac{5}{3\ (x-1)^3}-\frac{5}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)\ H(0,1,c_1(\alpha_0);x)+\Big(\frac{3\alpha_0^4}{2(x-1)}-\frac{3\ \alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{(x-1)^2}+8\alpha_0^3+$$

$$\frac{9\ \alpha_0^2}{x-1}-\frac{6\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-\frac{6\alpha_0}{x-1}+\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+\frac{6\ \alpha_0}{(x-1)^4}+24\alpha_0+\Big(\frac{2}{(x-1)^5}-6\Big)\ H(0;\alpha_0)+\Big(\frac{2d_1}{(x-1)^5}-$$

$$6d_1\Big)H(1;\alpha_0)-\frac{3}{4\ (x-1)}+\frac{1}{6(x-1)^2}+\frac{1}{6(x-1)^3}-\frac{3}{4\ (x-1)^4}-\frac{25}{12(x-1)^5}-\frac{25}{12}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4d_1}{x-1}-$$

$$\frac{2\ d_1}{(x-1)^2}+\frac{4d_1}{3(x-1)^3}-\frac{d_1}{(x-1)^4}+\frac{25\ d_1}{3(x-1)^5}+\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3\ (x-1)^3}-\frac{5}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)\ H(1,0,0;x)+$$

$$\Big(\frac{4d_1^2}{(x-1)^5}-\frac{2d_1}{(x-1)^5}-2\ d_1+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(1,0,1;x)+\Big(\frac{2\ d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2\ (x-1)^4}+$$

$$\frac{25d_1}{6(x-1)^5}+\Big(-\frac{4\ d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+2\Big)H(0;\alpha_0)+\Big(-\frac{4\ d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}+2d_1\Big)H(1;\alpha_0)-\frac{1}{4\ (x-1)}-\frac{1}{2(x-1)^2}+$$

$$\frac{7}{6(x-1)^3}-\frac{11}{4\ (x-1)^4}-\frac{25}{12(x-1)^5}-\frac{25}{4}\Big)\ H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{x-1}+\frac{2\ d_1^2}{(x-1)^2}-\frac{4d_1^2}{3\ (x-1)^3}+\frac{d_1^2}{(x-1)^4}-$$

$$\frac{25d_1^2}{3(x-1)^5}-\frac{9\ d_1}{2(x-1)}+\frac{8d_1}{3(x-1)^2}-\frac{7d_1}{3(x-1)^3}+\frac{3\ d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{6}+\frac{1}{4\ (x-1)}+\frac{1}{2(x-1)^2}-\frac{7}{6(x-1)^3}+\frac{11}{4\ (x-1)^4}+$$

$$\frac{25}{12(x-1)^5}+\frac{25}{4}\Big)\ H(1,1,0;x)+\Big(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{6\ d_1}{(x-1)^5}-4d_1+\frac{1}{(x-1)^5}+1\Big)H(0;\alpha_0)\ H(1,1,1;x)+$$

$$\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4\ d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3\ (x-1)^5}+\frac{9d_1}{2(x-1)}-\frac{8d_1}{3(x-1)^2}+\frac{7d_1}{3\ (x-1)^3}-\frac{3d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-\frac{25\ d_1}{6}+$$

$$\Big(-\frac{8d_1}{(x-1)^5}+4d_1+\frac{2}{(x-1)^5}+2\Big)\ H(0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{2\ d_1}{(x-1)^5}+2d_1\Big)H(1;\alpha_0)-\frac{1}{4(x-1)}-$$

$$\frac{1}{2\ (x-1)^2}+\frac{7}{6(x-1)^3}-\frac{11}{4(x-1)^4}-\frac{25}{12\ (x-1)^5}-\frac{25}{4}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{6d_1}{x-1}+\ \frac{3d_1}{(x-1)^2}-\frac{2d_1}{(x-1)^3}+$$

$$\frac{3d_1}{2\ (x-1)^4}-\frac{25d_1}{2(x-1)^5}+\Big(\frac{4\ d_1}{(x-1)^5}+\frac{2}{(x-1)^5}-6\Big)H(0;\alpha_0)+\Big(\frac{4\ d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}-6d_1\Big)H(1;\alpha_0)-\frac{9}{4\ (x-1)}+$$

$$\frac{13}{6(x-1)^2}-\frac{17}{6(x-1)^3}+\frac{21}{4\ (x-1)^4}-\frac{25}{12(x-1)^5}+\frac{125}{12}\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{4\ \alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}+$$

$$\frac{16\alpha_0^3}{3}+\frac{6\ \alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\ \alpha_0}{(x-1)^4}+16\alpha_0+\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\ H(1;\alpha_0)}{(x-1)^5}-$$

$$\frac{3}{x-1}+\frac{2}{3(x-1)^2}+\frac{2}{3\ (x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{3}\Big)\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(-\frac{7\alpha_0^4}{4(x-1)}+\frac{7\ \alpha_0^4}{4}+\frac{7\alpha_0^3}{x-1}-$$

$$\frac{7\alpha_0^3}{3(x-1)^2}-\frac{28\ \alpha_0^3}{3}-\frac{21\alpha_0^2}{2(x-1)}+\frac{7\alpha_0^2}{(x-1)^2}-\frac{7\ \alpha_0^2}{2(x-1)^3}+21\alpha_0^2+\frac{7\alpha_0}{x-1}-\frac{7\ \alpha_0}{(x-1)^2}+\frac{7\alpha_0}{(x-1)^3}-\frac{7\alpha_0}{(x-1)^4}-28\ \alpha_0-\frac{6H(0;\alpha_0)}{(x-1)^5}-$$

$$\frac{6d_1\ H(1;\alpha_0)}{(x-1)^5}+\frac{21}{4(x-1)}-\frac{7}{6(x-1)^2}-\frac{7}{6\ (x-1)^3}+\frac{21}{4(x-1)^4}+\frac{175}{12\ (x-1)^5}+\frac{175}{12}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+$$

$$8\ H(0,0,0,0;x)+\Big(\frac{4}{(x-1)^5}-4\Big)\ H(0,0,0,c_1(\alpha_0);x)+\Big(4-\frac{4}{(x-1)^5}\Big)\ H(0,0,1,0;x)+\Big(\frac{4}{(x-1)^5}-$$

$$4\Big)\ H(0,0,1,c_1(\alpha_0);x)-\frac{4\ H(0,0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\Big(\frac{4d_1}{(x-1)^5}-4d_1\ \Big)H(0,1,0,0;x)+\Big(-\frac{2d_1}{(x-1)^5}-2\ d_1+$$

$$
\begin{aligned}
&\left.\frac{4}{(x-1)^5}\right)H(0,1,0,c_1(\alpha_0);x)+\left(-\frac{4\ d_1^2}{(x-1)^5}+4d_1^2+\frac{2d_1}{(x-1)^5}+2d_1-\frac{4}{(x-1)^5}\right)H(0,1,1,0;x)+\left(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\right.\\
&\left.\frac{2\ d_1}{(x-1)^5}-2d_1+\frac{4}{(x-1)^5}\right)H(0,1,1,c_1(\alpha_0);x)+\left(-\ \frac{2d_1}{(x-1)^5}+6d_1-\frac{4}{(x-1)^5}\right)\ H(0,1,c_1(\alpha_0),c_1(\alpha_0);x)+\\
&4\ H(0,c_1(\alpha_0),0,c_1(\alpha_0);x)+\left(\frac{1}{(x-1)^5}-7\right)\ H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\left(4-\right.\\
&\left.\frac{4}{(x-1)^5}\right)\ H(1,0,0,0;x)+\left(\frac{2}{(x-1)^5}-2\right)H(1,0,0,c_1(\alpha_0);x)+\left(-\ \frac{4d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}+2\ d_1-\frac{2}{(x-1)^5}+\right.\\
&\left.2\right)H(1,0,1,0;x)+\left(\frac{4\ d_1^2}{(x-1)^5}-\frac{2d_1}{(x-1)^5}-2d_1+\frac{2}{(x-1)^5}-2\right)\ H(1,0,1,c_1(\alpha_0);x)+\left(-\frac{2\ d_1}{(x-1)^5}+\frac{1}{(x-1)^5}+\right.\\
&\left.1\right)\ H(1,0,c_1(\alpha_0),c_1(\alpha_0);x)+\left(\frac{8d_1}{(x-1)^5}-4\ d_1-\frac{2}{(x-1)^5}-2\right)H(1,1,0,0;x)+\left(\frac{4\ d_1^2}{(x-1)^5}-\frac{4d_1}{(x-1)^5}-2d_1+\right.\\
&\left.\frac{1}{(x-1)^5}+1\right)\ H(1,1,0,c_1(\alpha_0);x)+\left(-\ \frac{12d_1^2}{(x-1)^5}+4d_1^2+\frac{6\ d_1}{(x-1)^5}+4d_1-\frac{1}{(x-1)^5}-1\right)\ H(1,1,1,0;x)+\\
&\left(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{6\ d_1}{(x-1)^5}-4d_1+\frac{1}{(x-1)^5}+1\right)\ H(1,1,1,c_1(\alpha_0);x)+\left(-\ \frac{4d_1^2}{(x-1)^5}-\frac{4\ d_1}{(x-1)^5}+6d_1+\right.\\
&\left.\frac{1}{(x-1)^5}+1\right)\ H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+\left(4-\frac{4d_1}{(x-1)^5}\right)H(1,c_1(\ \alpha_0),0,c_1(\alpha_0);x)+\left(\frac{6\ d_1}{(x-1)^5}+\frac{1}{(x-1)^5}-\right.\\
&\left.7\right)\ H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{4\ H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{6\ H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\\
&\frac{4\ H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\frac{7\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+H(0;x)\ \left(-\frac{63d_1^2}{16(x-1)}+\frac{19d_1^2}{54(x-1)^2}+\frac{19\ d_1^2}{54(x-1)^3}-\right.\\
&\frac{63d_1^2}{16(x-1)^4}-\frac{2035d_1^2}{432\ (x-1)^5}-\frac{2035d_1^2}{432}+\frac{209d_1}{48(x-1)}-\frac{347\ d_1}{216(x-1)^2}-\frac{173d_1}{216(x-1)^3}+\frac{197d_1}{16\ (x-1)^4}+\frac{8705d_1}{432(x-1)^5}+\frac{5615d_1}{432}+\frac{3\ \pi^2}{8(x-1)}+\\
&\frac{2}{x-1}-\frac{\pi^2}{12\ (x-1)^2}+\frac{19}{216(x-1)^2}-\frac{\pi^2}{12\ (x-1)^3}+\frac{205}{216(x-1)^3}+\frac{3\pi^2}{8\ (x-1)^4}-\frac{163}{24(x-1)^4}+\frac{25\pi^2}{24\ (x-1)^5}-\frac{3965}{216(x-1)^5}+\frac{6\zeta_3}{(x-1)^5}+\\
&\left.10\ \zeta_3+\frac{25\pi^2}{24}-\frac{235}{27}\right)+H(1;x)\ \left(-\frac{\pi^2d_1}{3(x-1)}+\frac{\pi^2d_1}{6\ (x-1)^2}-\frac{\pi^2d_1}{9(x-1)^3}+\frac{\pi^2d_1}{12\ (x-1)^4}-\frac{25\pi^2d_1}{36(x-1)^5}-\frac{6\zeta_3\ d_1}{(x-1)^5}+\left(-\frac{4d_1^2}{x-1}+\right.\right.\\
&\frac{d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\ (x-1)^5}+\frac{97d_1}{24(x-1)}-\frac{157d_1}{36(x-1)^2}+\frac{137\ d_1}{36(x-1)^3}-\frac{19d_1}{8(x-1)^4}+\frac{835d_1}{72(x-1)^5}+\ \frac{205d_1}{72}+\\
&\left.\frac{97}{12(x-1)}-\frac{179}{36\ (x-1)^2}+\frac{179}{36(x-1)^3}-\frac{97}{12(x-1)^4}-\frac{\pi^2}{6\ (x-1)^5}+\frac{155}{36(x-1)^5}+\frac{\pi^2}{6}-\frac{155}{36}\right)\ H(0;\alpha_0)+\left(-\frac{4d_1}{x-1}+\frac{2d_1}{(x-1)^2}-\right.\\
&\left.\frac{4d_1}{3\ (x-1)^3}+\frac{d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}-\frac{5}{2\ (x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2\ (x-1)^4}-\frac{25}{6(x-1)^5}+\frac{25}{6}\right)\ H(0,0;\alpha_0)+\left(-\frac{4d_1^2}{x-1}+\right.\\
&\left.\frac{2d_1^2}{(x-1)^2}-\frac{4\ d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3\ (x-1)^5}-\frac{5d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3\ (x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25\ d_1}{6}\right)H(0,1;\alpha_0)+\\
&\left(\frac{4}{(x-1)^5}-4\right)\ H(0,0,0;\alpha_0)+\left(\frac{4d_1}{(x-1)^5}-4d_1\right)H(0,0,1;\alpha_0)+\left(\ \frac{4d_1}{(x-1)^5}-4d_1\right)H(0,1,0;\alpha_0)+\left(\frac{4\ d_1^2}{(x-1)^5}-\right.\\
&\left.\left.4d_1^2\right)H(0,1,1;\alpha_0)+\frac{\pi^2}{24\ (x-1)}+\frac{\pi^2}{12(x-1)^2}-\frac{7\pi^2}{36(x-1)^3}+\frac{11\ \pi^2}{24(x-1)^4}+\frac{25\pi^2}{72\ (x-1)^5}-\frac{\zeta_3}{(x-1)^5}+7\zeta_3+\frac{25\pi^2}{24}\right)+\\
&\frac{5d_1\pi^2}{16(x-1)}-\frac{\pi^2}{2(x-1)}-\frac{5d_1\pi^2}{108(x-1)^2}+\frac{13\pi^2}{216(x-1)^2}-\frac{5d_1\pi^2}{108(x-1)^3}+\frac{7\pi^2}{216(x-1)^3}+\frac{5d_1\pi^2}{16\ (x-1)^4}-\frac{\pi^2}{24(x-1)^4}-\frac{23\pi^4}{180\ (x-1)^5}+\\
&\frac{205d_1\pi^2}{432(x-1)^5}-\frac{155\pi^2}{216\ (x-1)^5}-\frac{21\zeta_3}{4(x-1)}+\frac{7\zeta_3}{6\ (x-1)^2}+\frac{7\zeta_3}{6(x-1)^3}-\frac{21\zeta_3}{4\ (x-1)^4}-\frac{175\zeta_3}{12(x-1)^5}-\frac{175\ \zeta_3}{12}-\frac{17\pi^4}{144}+\frac{205d_1\pi^2}{432}-\frac{65\pi^2}{54}.
\end{aligned}
$$

D.5 The $\mathcal{A}$ integral for $k=-1$ and $\kappa=1$

The ε expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,2,0,g_A) &= x\,\mathcal{A}(\varepsilon,x;3+d_1\varepsilon;1,2)\\
&= \frac{1}{\varepsilon^2}a_{-2}^{(1,-1)}+\frac{1}{\varepsilon}a_{-1}^{(1,-1)}+a_0^{(1,-1)}+\varepsilon a_1^{(1,-1)}+\varepsilon^2 a_2^{(1,-1)}+\mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{D.5}
$$

where

$$a_{-2}^{(1,-1)}=\tfrac{1}{6},$$

$$a_{-1}^{(1,-1)}=-\tfrac{2}{3}H(0;x),$$

$$a_0^{(1,-1)} = \frac{\alpha_0^3}{12(x-1)^2} - \frac{\alpha_0^3}{12} + \frac{\alpha_0^2}{24(x-1)} - \frac{5\alpha_0^2}{24(x-1)^2} + \frac{7\alpha_0^2}{24(x-1)^3} + \frac{13\alpha_0^2}{24} - \frac{\alpha_0}{3(x-1)} + \frac{\alpha_0}{6(x-1)^2} - \frac{\alpha_0}{3(x-1)^3} + \frac{13\alpha_0}{12(x-1)^4} - \frac{23\alpha_0}{12} + \Big(\frac{25}{12} + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5}\Big) H(0;\alpha_0) + \Big(-\frac{25}{12} - \frac{3}{4(x-1)} + \frac{1}{6(x-1)^2} + \frac{1}{6(x-1)^3} - \frac{3}{4(x-1)^4} - \frac{25}{12(x-1)^5}\Big) H(0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big) H(0;\alpha_0)\, H(1;x) + \Big(-\frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} + \frac{\alpha_0^3}{x-1} - \frac{\alpha_0^3}{3(x-1)^2} - \frac{4\alpha_0^3}{3} - \frac{3\alpha_0^2}{2(x-1)} + \frac{\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{2(x-1)^3} + 3\alpha_0^2 + \frac{\alpha_0}{x-1} - \frac{\alpha_0}{(x-1)^2} + \frac{\alpha_0}{(x-1)^3} - \frac{\alpha_0}{(x-1)^4} - 4\alpha_0 + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big) H(c_1(\alpha_0);x) + \frac{8}{3} H(0,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big) H(0,c_1(\alpha_0);x) + \Big(1 - \frac{1}{(x-1)^5}\Big) H(1,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big) H(1,c_1(\alpha_0);x) - \frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{\pi^2}{36},$$

$$a_1^{(1,-1)} = \frac{7d_1\alpha_0^3}{72} - \frac{7d_1\alpha_0^3}{72(x-1)^2} + \frac{7\alpha_0^3}{36(x-1)^2} - \frac{7\alpha_0^3}{36} - \frac{109d_1\alpha_0^2}{144} - \frac{13d_1\alpha_0^2}{144(x-1)} - \frac{\alpha_0^2}{36(x-1)} + \frac{29d_1\alpha_0^2}{144(x-1)^2} - \frac{11\alpha_0^2}{18(x-1)^2} - \frac{67d_1\alpha_0^2}{144(x-1)^3} + \frac{41\alpha_0^2}{36(x-1)^3} + \frac{31\alpha_0^2}{18} + \frac{305d_1\alpha_0}{72} + \frac{19d_1\alpha_0}{18(x-1)} - \frac{25\alpha_0}{36(x-1)} - \frac{d_1\alpha_0}{9(x-1)^2} + \frac{23\alpha_0}{36(x-1)^2} + \frac{d_1\alpha_0}{18(x-1)^3} - \frac{55\alpha_0}{36(x-1)^3} - \frac{217d_1\alpha_0}{72(x-1)^4} + \frac{569\alpha_0}{72(x-1)^4} - \frac{775\alpha_0}{72} + \Big(-\frac{\alpha_0^3}{3(x-1)^2} + \frac{\alpha_0^3}{3} - \frac{\alpha_0^2}{6(x-1)} + \frac{5\alpha_0^2}{6(x-1)^2} - \frac{7\alpha_0^2}{6(x-1)^3} - \frac{13\alpha_0^2}{6} + \frac{4\alpha_0}{3(x-1)} - \frac{2\alpha_0}{3(x-1)^2} + \frac{4\alpha_0}{3(x-1)^3} - \frac{13\alpha_0}{3(x-1)^4} + \frac{23\alpha_0}{3} - \frac{205d_1}{72} - \frac{15d_1}{8(x-1)} + \frac{5}{8(x-1)} + \frac{5d_1}{18(x-1)^2} - \frac{7}{18(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{13}{18(x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{49}{8(x-1)^4} - \frac{205d_1}{72(x-1)^5} + \frac{935}{72(x-1)^5} + \frac{515}{72}\Big) H(0;\alpha_0) + \Big(\frac{15d_1}{8(x-1)} - \frac{5d_1}{18(x-1)^2} - \frac{5d_1}{18(x-1)^3} + \frac{15d_1}{8(x-1)^4} + \frac{205d_1}{72(x-1)^5} + \frac{205d_1}{72} - \frac{5}{8(x-1)} + \frac{7}{18(x-1)^2} + \frac{13}{18(x-1)^3} - \frac{49}{8(x-1)^4} + \frac{2\pi^2}{3(x-1)^5} - \frac{935}{72(x-1)^5} - \frac{\pi^2}{9} - \frac{515}{72}\Big) H(0;x) + \Big(\frac{d_1\alpha_0^3}{6} - \frac{d_1\alpha_0^3}{6(x-1)^2} - \frac{13d_1\alpha_0^2}{12} - \frac{d_1\alpha_0^2}{12(x-1)} + \frac{5d_1\alpha_0^2}{12(x-1)^2} - \frac{7d_1\alpha_0^2}{12(x-1)^3} + \frac{23d_1\alpha_0}{6} + \frac{2d_1\alpha_0}{3(x-1)} - \frac{d_1\alpha_0}{3(x-1)^2} + \frac{2d_1\alpha_0}{3(x-1)^3} - \frac{13d_1\alpha_0}{6(x-1)^4} - \frac{35d_1}{12} - \frac{7d_1}{12(x-1)} + \frac{d_1}{12(x-1)^2} - \frac{d_1}{12(x-1)^3} + \frac{13d_1}{6(x-1)^4}\Big) H(1;\alpha_0) + \Big(-\frac{d_1\alpha_0^4}{8} + \frac{d_1\alpha_0^4}{8(x-1)} - \frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} + \frac{13d_1\alpha_0^3}{18} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{3\alpha_0^3}{2(x-1)} + \frac{2d_1\alpha_0^3}{9(x-1)^2} - \frac{31\alpha_0^3}{36(x-1)^2} - \frac{55\alpha_0^3}{36} - \frac{23d_1\alpha_0^2}{12} + \frac{3d_1\alpha_0^2}{4(x-1)} - \frac{95\alpha_0^2}{24(x-1)} - \frac{2d_1\alpha_0^2}{3(x-1)^2} + \frac{27\alpha_0^2}{8(x-1)^2} + \frac{d_1\alpha_0^2}{2(x-1)^3} - \frac{59\alpha_0^2}{24(x-1)^3} + \frac{35\alpha_0^2}{8} + \frac{25d_1\alpha_0}{6} - \frac{d_1\alpha_0}{2(x-1)} + \frac{43\alpha_0}{6(x-1)} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{37\alpha_0}{6(x-1)^2} - \frac{d_1\alpha_0}{(x-1)^3} + \frac{20\alpha_0}{3(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{113\alpha_0}{12(x-1)^4} - \frac{41\alpha_0}{4} - \frac{205d_1}{72} + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(0;\alpha_0) + \Big(-\frac{d_1\alpha_0^4}{2} + \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8d_1\alpha_0^3}{3} - \frac{2d_1\alpha_0^3}{x-1} + \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6d_1\alpha_0^2 + \frac{3d_1\alpha_0^2}{x-1} - \frac{2d_1\alpha_0^2}{(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} + 8d_1\alpha_0 - \frac{2d_1\alpha_0}{x-1} + \frac{2d_1\alpha_0}{(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5}\Big) H(1;\alpha_0) - \frac{15d_1}{8(x-1)} + \frac{5}{8(x-1)} + \frac{5d_1}{18(x-1)^2} - \frac{7}{18(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{13}{18(x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{49}{8(x-1)^4} - \frac{205d_1}{72(x-1)^5} + \frac{935}{72(x-1)^5} + \frac{515}{72}\Big) H(c_1(\alpha_0);x) + \Big(-\frac{25}{3} - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(\frac{25}{3} + \frac{3}{x-1} - \frac{2}{3(x-1)^2} - \frac{2}{3(x-1)^3} + \frac{3}{(x-1)^4} + \frac{25}{3(x-1)^5}\Big) H(0,0;x) + \Big(-\frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} - \frac{25d_1}{6}\Big) H(0,1;\alpha_0) + H(1;x)\, \Big(-\frac{\pi^2 d_1}{3(x-1)^5} + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} + \frac{5}{4(x-1)} - \frac{5}{6(x-1)^2} + \frac{5}{6(x-1)^3} - \frac{5}{4(x-1)^4} + \frac{25}{12(x-1)^5} - \frac{25}{12}\Big) H(0;\alpha_0) + \Big(4 - \frac{4}{(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(0,1;\alpha_0) + \frac{\pi^2}{2(x-1)^5} + \frac{\pi^2}{6}\Big) + \Big(\frac{2d_1}{(x-1)^5} - 2d_1 - \frac{2}{(x-1)^5} + 2\Big) H(0;\alpha_0) H(0,1;x) + \Big(-\frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} - \frac{8\alpha_0^3}{3} - \frac{3\alpha_0^2}{x-1} + \frac{2\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} + 6\alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} - 8\alpha_0 + \Big(4 - \frac{4}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big) H(0,c_1(\alpha_0);x) + \Big(-\frac{2d_1}{x-1} + \frac{d_1}{(x-1)^2} - \frac{2d_1}{3(x-1)^3} + \frac{d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} - \frac{5}{4(x-1)} + \frac{5}{6(x-1)^2} - \frac{5}{6(x-1)^3} + \frac{5}{4(x-1)^4} - \frac{25}{12(x-1)^5} + \frac{25}{12}\Big) H(1,0;x) + \Big(\frac{4d_1}{(x-1)^5} - 2d_1 - \frac{3}{(x-1)^5} - 1\Big) H(0;\alpha_0) H(1,1;x) + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} + \Big(4 - \frac{4}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{5}{4(x-1)} - \frac{5}{6(x-1)^2} + \frac{5}{6(x-1)^3} - \frac{5}{4(x-1)^4} + \frac{25}{12(x-1)^5} - \frac{25}{12}\Big) H(1,c_1(\alpha_0);x) + \Big(\frac{5\alpha_0^4}{4(x-1)} -$$

$$
\frac{5\alpha_0^4}{4}-\frac{5\alpha_0^3}{x-1}+\frac{5\alpha_0^3}{3(x-1)^2}+\frac{20\alpha_0^3}{3}+\frac{15\alpha_0^2}{2(x-1)}-\frac{5\alpha_0^2}{(x-1)^2}+\frac{5\alpha_0^2}{2(x-1)^3}-15\alpha_0^2-\frac{5\alpha_0}{x-1}+\frac{5\alpha_0}{(x-1)^2}-\frac{5\alpha_0}{(x-1)^3}+\frac{5\alpha_0}{(x-1)^4}+20\alpha_0+
\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1 H(1;\alpha_0)}{(x-1)^5}-\frac{15}{4(x-1)}+\frac{5}{6(x-1)^2}+\frac{5}{6(x-1)^3}-\frac{15}{4(x-1)^4}-\frac{125}{12(x-1)^5}-\frac{125}{12}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)-
\frac{32}{3}H(0,0,0;x)+\left(2-\frac{2}{(x-1)^5}\right)H(0,0,c_1(\alpha_0);x)+\left(-\frac{2d_1}{(x-1)^5}+2d_1+\frac{2}{(x-1)^5}-2\right)H(0,1,0;x)+\Big(\frac{2d_1}{(x-1)^5}-
2d_1-\frac{2}{(x-1)^5}+2\Big)H(0,1,c_1(\alpha_0);x)+\left(5-\frac{1}{(x-1)^5}\right)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\left(\frac{4}{(x-1)^5}-4\right)H(1,0,0;x)+
\left(\frac{2d_1}{(x-1)^5}-\frac{3}{(x-1)^5}-1\right)H(1,0,c_1(\alpha_0);x)+\left(-\frac{4d_1}{(x-1)^5}+2d_1+\frac{3}{(x-1)^5}+1\right)H(1,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2d_1-
\frac{3}{(x-1)^5}-1\Big)H(1,1,c_1(\alpha_0);x)+\left(-\frac{2d_1}{(x-1)^5}-\frac{1}{(x-1)^5}+5\right)H(1,c_1(\alpha_0),c_1(\alpha_0);x)-\frac{2H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+
\frac{5H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{8(x-1)}+\frac{\pi^2}{36(x-1)^2}+\frac{\pi^2}{36(x-1)^3}-\frac{\pi^2}{8(x-1)^4}-\frac{25\pi^2}{72(x-1)^5}-\frac{3\zeta_3}{(x-1)^5}-6\zeta_3-\frac{25\pi^2}{72},
$$

$$
a_2^{(1,-1)}=-\frac{37}{432}d_1^2\alpha_0^3+\frac{37d_1\alpha_0^3}{108}+\frac{37d_1^2\alpha_0^3}{432(x-1)^2}-\frac{37d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi^2\alpha_0^3}{72(x-1)^2}+\frac{37\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\alpha_0^3}{72}-\frac{37\alpha_0^3}{108}+
\frac{715d_1^2\alpha_0^2}{864}-\frac{1625d_1\alpha_0^2}{432}+\frac{115d_1^2\alpha_0^2}{864(x-1)}-\frac{35d_1\alpha_0^2}{432(x-1)}-\frac{\pi^2\alpha_0^2}{144(x-1)}-\frac{10\alpha_0^2}{27(x-1)}-\frac{107d_1^2\alpha_0^2}{864(x-1)^2}+\frac{409d_1\alpha_0^2}{432(x-1)^2}+\frac{5\pi^2\alpha_0^2}{144(x-1)^2}-
\frac{151\alpha_0^2}{108(x-1)^2}+\frac{493d_1^2\alpha_0^2}{864(x-1)^3}-\frac{1181d_1\alpha_0^2}{432(x-1)^3}-\frac{7\pi^2\alpha_0^2}{144(x-1)^3}+\frac{86\alpha_0^2}{27(x-1)^3}-\frac{13\pi^2\alpha_0^2}{144}+\frac{455\alpha_0^2}{108}-\frac{3515d_1^2\alpha_0}{432}+\frac{17285d_1\alpha_0}{432}-
\frac{265d_1^2\alpha_0}{108(x-1)}+\frac{1205d_1\alpha_0}{216(x-1)}+\frac{\pi^2\alpha_0}{18(x-1)}+\frac{13\alpha_0}{54(x-1)}-\frac{d_1^2\alpha_0}{108(x-1)^2}-\frac{187d_1\alpha_0}{216(x-1)^2}-\frac{\pi^2\alpha_0}{36(x-1)^2}+\frac{191\alpha_0}{108(x-1)^2}+\frac{113d_1^2\alpha_0}{108(x-1)^3}+
\frac{11d_1\alpha_0}{216(x-1)^3}+\frac{\pi^2\alpha_0}{18(x-1)^3}-\frac{317\alpha_0}{54(x-1)^3}+\frac{2911d_1^2\alpha_0}{432(x-1)^4}-\frac{14479d_1\alpha_0}{432(x-1)^4}-\frac{13\pi^2\alpha_0}{72(x-1)^4}+\frac{2207\alpha_0}{54(x-1)^4}+\frac{23\pi^2\alpha_0}{72}-\frac{5213\alpha_0}{108}+\Big(-
\frac{7d_1\alpha_0^3}{18}+\frac{7d_1\alpha_0^3}{18(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}+\frac{7\alpha_0^3}{9}+\frac{109d_1\alpha_0^2}{36}+\frac{13d_1\alpha_0^2}{36(x-1)}+\frac{\alpha_0^2}{9(x-1)}-\frac{29d_1\alpha_0^2}{36(x-1)^2}+\frac{22\alpha_0^2}{9(x-1)^2}+\frac{67d_1\alpha_0^2}{36(x-1)^3}-\frac{41\alpha_0^2}{9(x-1)^3}-
\frac{62\alpha_0^2}{9}-\frac{305d_1\alpha_0}{18}-\frac{38d_1\alpha_0}{9(x-1)}+\frac{25\alpha_0}{9(x-1)}+\frac{4d_1\alpha_0}{9(x-1)^2}-\frac{23\alpha_0}{9(x-1)^2}-\frac{2d_1\alpha_0}{9(x-1)^3}+\frac{55\alpha_0}{9(x-1)^3}+\frac{217d_1\alpha_0}{18(x-1)^4}-\frac{569\alpha_0}{18(x-1)^4}+\frac{775\alpha_0}{18}+
\frac{2035d_1^2}{432}-\frac{9685d_1}{432}+\frac{63d_1^2}{16(x-1)}-\frac{407d_1}{48(x-1)}-\frac{\pi^2}{8(x-1)}-\frac{37}{8(x-1)}-\frac{19d_1^2}{54(x-1)^2}+\frac{80d_1}{27(x-1)^2}+\frac{\pi^2}{36(x-1)^2}-\frac{101}{108(x-1)^2}-
\frac{19d_1^2}{54(x-1)^3}+\frac{73d_1}{54(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-\frac{365}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{1171d_1}{48(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{239}{8(x-1)^4}+\frac{2035d_1^2}{432(x-1)^5}-
\frac{15865d_1}{432(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+\frac{13505}{216(x-1)^5}-\frac{25\pi^2}{72}+\frac{5525}{216}\Big)H(0;\alpha_0)+\Big(-\frac{7}{36}d_1^2\alpha_0^3+\frac{7d_1\alpha_0^3}{18}+\frac{7d_1^2\alpha_0^3}{36(x-1)^2}-\frac{7d_1\alpha_0^3}{18(x-1)^2}+
\frac{109d_1^2\alpha_0^2}{72}-\frac{31d_1\alpha_0^2}{9}+\frac{13d_1^2\alpha_0^2}{72(x-1)}+\frac{d_1\alpha_0^2}{18(x-1)}-\frac{29d_1^2\alpha_0^2}{72(x-1)^2}+\frac{11d_1\alpha_0^2}{9(x-1)^2}+\frac{67d_1^2\alpha_0^2}{72(x-1)^3}-\frac{41d_1\alpha_0^2}{18(x-1)^3}-\frac{305d_1^2\alpha_0}{36}+\frac{775d_1\alpha_0}{36}-
\frac{19d_1^2\alpha_0}{9(x-1)}+\frac{25d_1\alpha_0}{18(x-1)}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-\frac{23d_1\alpha_0}{18(x-1)^2}-\frac{d_1^2\alpha_0}{9(x-1)^3}+\frac{55d_1\alpha_0}{18(x-1)^3}+\frac{217d_1^2\alpha_0}{36(x-1)^4}-\frac{569d_1\alpha_0}{36(x-1)^4}+\frac{515d_1^2}{72}-\frac{665d_1}{36}+
\frac{139d_1^2}{72(x-1)}-\frac{13d_1}{9(x-1)}-\frac{d_1^2}{72(x-1)^2}+\frac{4d_1}{9(x-1)^2}-\frac{59d_1^2}{72(x-1)^3}-\frac{7d_1}{9(x-1)^3}-\frac{217d_1^2}{36(x-1)^4}+\frac{569d_1}{36(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{4\alpha_0^3}{3(x-1)^2}-
\frac{4\alpha_0^3}{3}+\frac{2\alpha_0^2}{3(x-1)}-\frac{10\alpha_0^2}{3(x-1)^2}+\frac{14\alpha_0^2}{3(x-1)^3}+\frac{26\alpha_0^2}{3}-\frac{16\alpha_0}{3(x-1)}+\frac{8\alpha_0}{3(x-1)^2}-\frac{16\alpha_0}{3(x-1)^3}+\frac{52\alpha_0}{3(x-1)^4}-\frac{92\alpha_0}{3}+\frac{205d_1}{18}+
\frac{15d_1}{2(x-1)}-\frac{5}{2(x-1)}-\frac{10d_1}{9(x-1)^2}+\frac{14}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}+\frac{26}{9(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{49}{2(x-1)^4}+\frac{205d_1}{18(x-1)^5}-\frac{935}{18(x-1)^5}-
\frac{515}{18}\Big)H(0,0;\alpha_0)+\Big(-\frac{15d_1}{2(x-1)}+\frac{10d_1}{9(x-1)^2}+\frac{10d_1}{9(x-1)^3}-\frac{15d_1}{2(x-1)^4}-\frac{205d_1}{18(x-1)^5}-\frac{205d_1}{18}+\frac{5}{2(x-1)}-\frac{14}{9(x-1)^2}-
\frac{26}{9(x-1)^3}+\frac{49}{2(x-1)^4}-\frac{8\pi^2}{3(x-1)^5}+\frac{935}{18(x-1)^5}+\frac{4\pi^2}{9}+\frac{515}{18}\Big)H(0,0;x)+\Big(-\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-
\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{205d_1^2}{36}-\frac{515d_1}{36}+\frac{15d_1^2}{4(x-1)}-\frac{5d_1}{4(x-1)}-
\frac{5d_1^2}{9(x-1)^2}+\frac{7d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}+\frac{13d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{49d_1}{4(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{935d_1}{36(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(\frac{\pi^2d_1}{(x-1)^5}+
\frac{\pi^2d_1}{3}+\Big(\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5d_1}{3(x-1)^3}-\frac{5d_1}{2(x-1)^4}+\frac{25d_1}{6(x-1)^5}-\frac{25d_1}{6}+\frac{5}{2(x-1)}-\frac{5}{3(x-1)^2}+\frac{5}{3(x-1)^3}-\frac{5}{2(x-1)^4}+
\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)H(0;\alpha_0)+\left(-\frac{8d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}-8\right)H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{4d_1}{(x-1)^5}-
4d_1\Big)H(0,1;\alpha_0)-\frac{7\pi^2}{3(x-1)^5}-\frac{\pi^2}{3}\Big)H(0,1;x)+\Big(-\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3(x-1)^3}-
\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{35d_1}{3}+\frac{7d_1}{3(x-1)}-\frac{d_1}{3(x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{26d_1}{3(x-1)^4}\Big)H(1,0;\alpha_0)+
\Big(\frac{4d_1^2}{x-1}-\frac{d_1^2}{(x-1)^2}+\frac{4d_1^2}{9(x-1)^3}-\frac{d_1^2}{4(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{193d_1}{24(x-1)}+\frac{265d_1}{36(x-1)^2}-\frac{25d_1}{4(x-1)^3}+\frac{107d_1}{24(x-1)^4}+\frac{4\pi^2d_1}{3(x-1)^5}-
$$

$$\frac{185d_1}{8(x-1)^5} - \frac{205d_1}{72} - \frac{133}{8(x-1)} + \frac{289}{36(x-1)^2} - \frac{289}{36(x-1)^3} + \frac{133}{8(x-1)^4} - \frac{11\pi^2}{6(x-1)^5} - \frac{305}{72(x-1)^5} - \frac{5\pi^2}{6} + \frac{305}{72}\Big) H(1,0;x) +$$

$$\Big(-\frac{1}{3}d_1^2\alpha_0^3 + \frac{d_1^2\alpha_0^3}{3(x-1)^2} + \frac{13d_1^2\alpha_0^2}{6} + \frac{d_1^2\alpha_0^2}{6(x-1)} - \frac{5d_1^2\alpha_0^2}{6(x-1)^2} + \frac{7d_1^2\alpha_0^2}{6(x-1)^3} - \frac{23d_1^2\alpha_0}{3} - \frac{4d_1^2\alpha_0}{3(x-1)} + \frac{2d_1^2\alpha_0}{3(x-1)^2} - \frac{4d_1^2\alpha_0}{3(x-1)^3} +$$

$$\frac{13d_1^2\alpha_0}{3(x-1)^4} + \frac{35d_1^2}{6} + \frac{7d_1^2}{6(x-1)} - \frac{d_1^2}{6(x-1)^2} + \frac{d_1^2}{6(x-1)^3} - \frac{13d_1^2}{3(x-1)^4}\Big) H(1,1;\alpha_0) + H(0,c_1(\alpha_0);x)\Big(-\frac{d_1\alpha_0^4}{4} + \frac{d_1\alpha_0^4}{4(x-1)} -$$

$$\frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} + \frac{13d_1\alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{3\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{25\alpha_0^3}{18(x-1)^2} - \frac{61\alpha_0^3}{18} - \frac{23d_1\alpha_0^2}{6} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{31\alpha_0^2}{4(x-1)} - \frac{4d_1\alpha_0^2}{3(x-1)^2} +$$

$$\frac{71\alpha_0^2}{12(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{15\alpha_0^2}{4(x-1)^3} + \frac{131\alpha_0^2}{12} + \frac{25d_1\alpha_0}{3} - \frac{d_1\alpha_0}{x-1} + \frac{13\alpha_0}{x-1} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{35\alpha_0}{3(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{12\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} -$$

$$\frac{29\alpha_0}{2(x-1)^4} - \frac{169\alpha_0}{6} - \frac{205d_1}{72} + \Big(\frac{2\alpha_0^4}{x-1} - 2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} + \frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} - 24\alpha_0^2 - \frac{8\alpha_0}{x-1} +$$

$$\frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} + 32\alpha_0 - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(0;\alpha_0) + \Big(-d_1\alpha_0^4 +$$

$$\frac{d_1\alpha_0^4}{x-1} + \frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} - 12d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} + 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} +$$

$$\frac{4d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5}\Big) H(1;\alpha_0) + \Big(\frac{16}{(x-1)^5} - 16\Big) H(0,0;\alpha_0) +$$

$$\Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(0,1;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2\Big) H(1,1;\alpha_0) - \frac{15d_1}{8(x-1)} + \frac{71}{8(x-1)} +$$

$$\frac{5d_1}{18(x-1)^2} - \frac{8}{9(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{2}{9(x-1)^3} - \frac{15d_1}{8(x-1)^4} - \frac{17}{8(x-1)^4} - \frac{205d_1}{72(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{305}{72(x-1)^5} + \frac{\pi^2}{6} +$$

$$\frac{1145}{72}\Big) + H(c_1(\alpha_0);x)\Big(\frac{d_1^2\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{4} - \frac{d_1^2\alpha_0^4}{16(x-1)} + \frac{d_1\alpha_0^4}{4(x-1)} + \frac{\pi^2\alpha_0^4}{24(x-1)} - \frac{\alpha_0^4}{4(x-1)} - \frac{\pi^2\alpha_0^4}{24} + \frac{\alpha_0^4}{4} - \frac{43d_1^2\alpha_0^3}{108} + \frac{365d_1\alpha_0^3}{216} +$$

$$\frac{d_1^2\alpha_0^3}{4(x-1)} - \frac{19d_1\alpha_0^3}{12(x-1)} - \frac{\pi^2\alpha_0^3}{6(x-1)} + \frac{13\alpha_0^3}{6(x-1)} - \frac{4d_1^2\alpha_0^3}{27(x-1)^2} + \frac{233d_1\alpha_0^3}{216(x-1)^2} + \frac{\pi^2\alpha_0^3}{18(x-1)^2} - \frac{169\alpha_0^3}{108(x-1)^2} + \frac{2\pi^2\alpha_0^3}{9} - \frac{193\alpha_0^3}{108} +$$

$$\frac{95d_1^2\alpha_0^2}{72} - \frac{869d_1\alpha_0^2}{144} - \frac{3d_1^2\alpha_0^2}{8(x-1)} + \frac{695d_1\alpha_0^2}{144(x-1)} + \frac{\pi^2\alpha_0^2}{4(x-1)} - \frac{319\alpha_0^2}{36(x-1)} + \frac{4d_1^2\alpha_0^2}{9(x-1)^2} - \frac{641d_1\alpha_0^2}{144(x-1)^2} - \frac{\pi^2\alpha_0^2}{6(x-1)^2} + \frac{26\alpha_0^2}{3(x-1)^2} -$$

$$\frac{d_1^2\alpha_0^2}{2(x-1)^3} + \frac{623d_1\alpha_0^2}{144(x-1)^3} + \frac{\pi^2\alpha_0^2}{12(x-1)^3} - \frac{67\alpha_0^2}{9(x-1)^3} - \frac{\pi^2\alpha_0^2}{2} + \frac{27\alpha_0^2}{4} - \frac{205d_1^2\alpha_0}{36} + \frac{1945d_1\alpha_0}{72} + \frac{d_1^2\alpha_0}{4(x-1)} - \frac{505d_1\alpha_0}{36(x-1)} -$$

$$\frac{\pi^2\alpha_0}{6(x-1)} + \frac{299\alpha_0}{9(x-1)} - \frac{4d_1^2\alpha_0}{9(x-1)^2} + \frac{11d_1\alpha_0}{(x-1)^2} + \frac{\pi^2\alpha_0}{6(x-1)^2} - \frac{541\alpha_0}{18(x-1)^2} + \frac{d_1^2\alpha_0}{(x-1)^3} - \frac{239d_1\alpha_0}{18(x-1)^3} - \frac{\pi^2\alpha_0}{6(x-1)^3} + \frac{296\alpha_0}{9(x-1)^3} -$$

$$\frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{2237d_1\alpha_0}{72(x-1)^4} + \frac{\pi^2\alpha_0}{6(x-1)^4} - \frac{3835\alpha_0}{72(x-1)^4} + \frac{2\pi^2\alpha_0}{3} - \frac{739\alpha_0}{24} + \frac{2035d_1^2}{432} - \frac{9685d_1}{432} + \Big(\frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{x-1} - \alpha_0^4 -$$

$$\frac{26d_1\alpha_0^3}{9} + \frac{2d_1\alpha_0^3}{x-1} - \frac{6\alpha_0^3}{x-1} - \frac{8d_1\alpha_0^3}{9(x-1)^2} + \frac{31\alpha_0^3}{9(x-1)^2} + \frac{55\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{3} - \frac{3d_1\alpha_0^2}{x-1} + \frac{95\alpha_0^2}{6(x-1)} + \frac{8d_1\alpha_0^2}{3(x-1)^2} - \frac{27\alpha_0^2}{2(x-1)^2} - \frac{2d_1\alpha_0^2}{(x-1)^3} +$$

$$\frac{59\alpha_0^2}{6(x-1)^3} - \frac{35\alpha_0^2}{2} - \frac{50d_1\alpha_0}{3} + \frac{2d_1\alpha_0}{x-1} - \frac{86\alpha_0}{3(x-1)} - \frac{8d_1\alpha_0}{3(x-1)^2} + \frac{74\alpha_0}{3(x-1)^2} + \frac{4d_1\alpha_0}{(x-1)^3} - \frac{80\alpha_0}{3(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{113\alpha_0}{3(x-1)^4} +$$

$$41\alpha_0 + \frac{205d_1}{18} + \frac{15d_1}{2(x-1)} - \frac{5}{2(x-1)} - \frac{10d_1}{9(x-1)^2} + \frac{14}{9(x-1)^2} - \frac{10d_1}{9(x-1)^3} + \frac{26}{9(x-1)^3} + \frac{15d_1}{2(x-1)^4} - \frac{49}{2(x-1)^4} + \frac{205d_1}{18(x-1)^5} -$$

$$\frac{935}{18(x-1)^5} - \frac{515}{18}\Big) H(0;\alpha_0) + \Big(\frac{d_1^2\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{2} - \frac{d_1^2\alpha_0^4}{4(x-1)} + \frac{d_1\alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{9} + \frac{55d_1\alpha_0^3}{18} + \frac{d_1^2\alpha_0^3}{x-1} - \frac{3d_1\alpha_0^3}{x-1} - \frac{4d_1^2\alpha_0^3}{9(x-1)^2} +$$

$$\frac{31d_1\alpha_0^3}{18(x-1)^2} + \frac{23d_1^2\alpha_0^2}{6} - \frac{35d_1\alpha_0^2}{4} - \frac{3d_1^2\alpha_0^2}{2(x-1)} + \frac{95d_1\alpha_0^2}{12(x-1)} + \frac{4d_1^2\alpha_0^2}{3(x-1)^2} - \frac{27d_1\alpha_0^2}{4(x-1)^2} - \frac{d_1^2\alpha_0^2}{(x-1)^3} + \frac{59d_1\alpha_0^2}{12(x-1)^3} - \frac{25d_1^2\alpha_0}{3} + \frac{41d_1\alpha_0}{2} +$$

$$\frac{d_1^2\alpha_0}{x-1} - \frac{43d_1\alpha_0}{3(x-1)} - \frac{4d_1^2\alpha_0}{3(x-1)^2} + \frac{37d_1\alpha_0}{3(x-1)^2} + \frac{2d_1^2\alpha_0}{(x-1)^3} - \frac{40d_1\alpha_0}{3(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{113d_1\alpha_0}{6(x-1)^4} + \frac{205d_1^2}{36} - \frac{515d_1}{36} + \frac{15d_1^2}{4(x-1)} -$$

$$\frac{5d_1}{4(x-1)} - \frac{5d_1^2}{9(x-1)^2} + \frac{7d_1}{9(x-1)^2} - \frac{5d_1^2}{9(x-1)^3} + \frac{13d_1}{9(x-1)^3} + \frac{15d_1^2}{4(x-1)^4} - \frac{49d_1}{4(x-1)^4} + \frac{205d_1^2}{36(x-1)^5} - \frac{935d_1}{36(x-1)^5}\Big) H(1;\alpha_0) + \Big(-$$

$$\frac{4\alpha_0^4}{x-1} + 4\alpha_0^4 + \frac{16\alpha_0^3}{x-1} - \frac{16\alpha_0^3}{3(x-1)^2} - \frac{64\alpha_0^3}{3} - \frac{24\alpha_0^2}{x-1} + \frac{16\alpha_0^2}{(x-1)^2} - \frac{8\alpha_0^2}{(x-1)^3} + 48\alpha_0^2 + \frac{16\alpha_0}{x-1} - \frac{16\alpha_0}{(x-1)^2} + \frac{16\alpha_0}{(x-1)^3} - \frac{16\alpha_0}{(x-1)^4} -$$

$$64\alpha_0 + \frac{12}{x-1} - \frac{8}{3(x-1)^2} - \frac{8}{3(x-1)^3} + \frac{12}{(x-1)^4} + \frac{100}{3(x-1)^5} + \frac{100}{3}\Big) H(0,0;\alpha_0) + \Big(2d_1\alpha_0^4 - \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} +$$

$$\frac{8d_1\alpha_0^3}{x-1} - \frac{8d_1\alpha_0^3}{3(x-1)^2} + 24d_1\alpha_0^2 - \frac{12d_1\alpha_0^2}{x-1} + \frac{8d_1\alpha_0^2}{(x-1)^2} - \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 + \frac{8d_1\alpha_0}{x-1} - \frac{8d_1\alpha_0}{(x-1)^2} + \frac{8d_1\alpha_0}{(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{50d_1}{3} +$$

$$\frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5}\Big) H(0,1;\alpha_0) + \Big(2d_1\alpha_0^4 - \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} + \frac{8d_1\alpha_0^3}{x-1} - \frac{8d_1\alpha_0^3}{3(x-1)^2} +$$

$$24d_1\alpha_0^2 - \frac{12d_1\alpha_0^2}{x-1} + \frac{8d_1\alpha_0^2}{(x-1)^2} - \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 + \frac{8d_1\alpha_0}{x-1} - \frac{8d_1\alpha_0}{(x-1)^2} + \frac{8d_1\alpha_0}{(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{50d_1}{3} + \frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} -$$

$$\frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5}\Big) H(1,0;\alpha_0) + \Big(d_1^2\alpha_0^4 - \frac{d_1^2\alpha_0^4}{x-1} - \frac{16d_1^2\alpha_0^3}{3} + \frac{4d_1^2\alpha_0^3}{x-1} - \frac{4d_1^2\alpha_0^3}{3(x-1)^2} + 12d_1^2\alpha_0^2 - \frac{6d_1^2\alpha_0^2}{x-1} +$$

$$\frac{4d_1^2\alpha_0^2}{(x-1)^2} - \frac{2d_1^2\alpha_0^2}{(x-1)^3} - 16d_1^2\alpha_0 + \frac{4d_1^2\alpha_0}{x-1} - \frac{4d_1^2\alpha_0}{(x-1)^2} + \frac{4d_1^2\alpha_0}{(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{25d_1^2}{3} + \frac{3d_1^2}{x-1} - \frac{2d_1^2}{3(x-1)^2} - \frac{2d_1^2}{3(x-1)^3} + \frac{3d_1^2}{(x-1)^4} +$$

$$\frac{25d_1^2}{3(x-1)^5}\Big) H(1,1;\alpha_0) + \frac{63d_1^2}{16(x-1)} - \frac{407d_1}{48(x-1)} - \frac{\pi^2}{8(x-1)} - \frac{37}{8(x-1)} - \frac{19d_1^2}{54(x-1)^2} + \frac{80d_1}{27(x-1)^2} + \frac{\pi^2}{36(x-1)^2} - \frac{101}{108(x-1)^2} -$$

$$\frac{19d_1^2}{54(x-1)^3}+\frac{73\,d_1}{54(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-\frac{365}{108\,(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{1171d_1}{48\,(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{239}{8(x-1)^4}+\frac{2035\,d_1^2}{432(x-1)^5}-$$
$$\frac{15865d_1}{432(x-1)^5}-\frac{25\pi^2}{72\,(x-1)^5}+\frac{13505}{216(x-1)^5}-\frac{25\pi^2}{72}+\frac{5525}{216}\Big)+\Big(-\frac{2\pi^2d_1^2}{3(x-1)^5}+\frac{2\pi^2d_1}{(x-1)^5}+\frac{\pi^2d_1}{3}+\Big(\frac{4\,d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3\,(x-1)^3}-$$
$$\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{9\,d_1}{2(x-1)}-\frac{8d_1}{3(x-1)^2}+\frac{7d_1}{3(x-1)^3}-\frac{3\,d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-\frac{25d_1}{6}-\frac{13}{4\,(x-1)}+\frac{1}{6(x-1)^2}+\frac{11}{6(x-1)^3}-$$
$$\frac{23}{4(x-1)^4}-\frac{125}{12(x-1)^5}-\frac{175}{12}\Big)H(0;\alpha_0)+\Big(-\frac{16\,d_1}{(x-1)^5}+8d_1+\frac{12}{(x-1)^5}+4\Big)\,H(0,0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+$$
$$\frac{6\,d_1}{(x-1)^5}+2d_1\Big)H(0,1;\alpha_0)-\frac{7\pi^2}{6\,(x-1)^5}-\frac{5\pi^2}{6}\Big)H(1,1;x)+\Big(-\frac{4\,d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9\,(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\,(x-1)^5}+$$
$$\frac{193d_1}{24(x-1)}-\frac{265d_1}{36(x-1)^2}+\frac{25\,d_1}{4(x-1)^3}-\frac{107d_1}{24(x-1)^4}+\frac{185d_1}{8(x-1)^5}+\frac{205d_1}{72}+\Big(-\frac{8d_1}{x-1}+\frac{4\,d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50\,d_1}{3(x-1)^5}-$$
$$\frac{5}{x-1}+\frac{10}{3(x-1)^2}-\frac{10}{3\,(x-1)^3}+\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{25}{3}\Big)\,H(0;\alpha_0)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4\,d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-$$
$$\frac{25d_1^2}{3\,(x-1)^5}-\frac{5d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3\,(x-1)^3}+\frac{5d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25\,d_1}{6}\Big)H(1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-16\Big)\,H(0,0;\alpha_0)+$$
$$\Big(\frac{8d_1}{(x-1)^5}-8d_1\Big)\,H(0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8d_1\Big)\,H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big)\,H(1,1;\alpha_0)+\frac{133}{8(x-1)}-$$
$$\frac{289}{36(x-1)^2}+\frac{289}{36\,(x-1)^3}-\frac{133}{8(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+\frac{305}{72\,(x-1)^5}+\frac{\pi^2}{6}-\frac{305}{72}\Big)\,H(1,c_1(\alpha_0);x)+\Big(\frac{5d_1\alpha_0^4}{8}-\frac{5d_1\alpha_0^4}{8\,(x-1)}+$$
$$\frac{5\alpha_0^4}{4(x-1)}-\frac{5\alpha_0^4}{4}-\frac{65d_1\,\alpha_0^3}{18}+\frac{5d_1\alpha_0^3}{2(x-1)}-\frac{15\alpha_0^3}{2\,(x-1)}-\frac{10d_1\alpha_0^3}{9(x-1)^2}+\frac{137\alpha_0^3}{36\,(x-1)^2}+\frac{293\alpha_0^3}{36}+\frac{115d_1\alpha_0^2}{12}-\frac{15d_1\,\alpha_0^2}{4(x-1)}+\frac{469\alpha_0^2}{24(x-1)}+$$
$$\frac{10d_1\alpha_0^2}{3\,(x-1)^2}-\frac{125\alpha_0^2}{8(x-1)^2}-\frac{5d_1\alpha_0^2}{2\,(x-1)^3}+\frac{253\alpha_0^2}{24(x-1)^3}-\frac{201\alpha_0^2}{8}-\frac{125\,d_1\alpha_0}{6}+\frac{5d_1\alpha_0}{2(x-1)}-\frac{203\alpha_0}{6\,(x-1)}-\frac{10d_1\alpha_0}{3(x-1)^2}+\frac{179\alpha_0}{6(x-1)^2}+$$
$$\frac{5\,d_1\alpha_0}{(x-1)^3}-\frac{94\alpha_0}{3(x-1)^3}-\frac{10d_1\,\alpha_0}{(x-1)^4}+\frac{487\alpha_0}{12(x-1)^4}+\frac{251\alpha_0}{4}+\frac{1025\,d_1}{72}+\Big(-\frac{5\alpha_0^4}{x-1}+5\alpha_0^4+\frac{20\,\alpha_0^3}{x-1}-\frac{20\alpha_0^3}{3(x-1)^2}-\frac{80\alpha_0^3}{3}-$$
$$\frac{30\,\alpha_0^2}{x-1}+\frac{20\alpha_0^2}{(x-1)^2}-\frac{10\alpha_0^2}{(x-1)^3}+60\,\alpha_0^2+\frac{20\alpha_0}{x-1}-\frac{20\alpha_0}{(x-1)^2}+\frac{20\,\alpha_0}{(x-1)^3}-\frac{20\alpha_0}{(x-1)^4}-80\,\alpha_0+\frac{15}{x-1}-\frac{10}{3(x-1)^2}-\frac{10}{3\,(x-1)^3}+$$
$$\frac{15}{(x-1)^4}+\frac{125}{3(x-1)^5}+\frac{125}{3}\Big)\,H(0;\alpha_0)+\Big(\frac{5d_1\alpha_0^4}{2}-\frac{5d_1\alpha_0^4}{2\,(x-1)}-\frac{40d_1\alpha_0^3}{3}+\frac{10d_1\alpha_0^3}{x-1}-\frac{10d_1\,\alpha_0^3}{3(x-1)^2}+30d_1\alpha_0^2-\frac{15d_1\alpha_0^2}{x-1}+$$
$$\frac{10d_1\,\alpha_0^2}{(x-1)^2}-\frac{5d_1\alpha_0^2}{(x-1)^3}-40d_1\alpha_0+\frac{10d_1\,\alpha_0}{x-1}-\frac{10d_1\alpha_0}{(x-1)^2}+\frac{10d_1\,\alpha_0}{(x-1)^3}-\frac{10d_1\alpha_0}{(x-1)^4}+\frac{125d_1}{6}+\frac{15\,d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3\,(x-1)^3}+$$
$$\frac{15d_1}{2(x-1)^4}+\frac{125d_1}{6(x-1)^5}\Big)H(1;\;\alpha_0)-\frac{16H(0,0;\alpha_0)}{(x-1)^5}-\frac{8d_1\;H(0,1;\alpha_0)}{(x-1)^5}-\frac{8d_1H(1,0;\alpha_0)}{(x-1)^5}-\frac{4d_1^2\;H(1,1;\alpha_0)}{(x-1)^5}+\frac{75d_1}{8(x-1)}-$$
$$\frac{91}{8\,(x-1)}-\frac{25d_1}{18(x-1)^2}+\frac{22}{9(x-1)^2}-\frac{25\,d_1}{18(x-1)^3}+\frac{28}{9(x-1)^3}+\frac{75d_1}{8\,(x-1)^4}-\frac{179}{8(x-1)^4}+\frac{1025d_1}{72(x-1)^5}+\frac{\pi^{\;2}}{6(x-1)^5}-\frac{4045}{72(x-1)^5}-$$
$$\frac{3205}{72}\Big)\,H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{100}{3}+\frac{12}{x-1}-\frac{8}{3\,(x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}\Big)H(0,0,0;\alpha_0)+\Big(-$$
$$\frac{100}{3}-\frac{12}{x-1}+\frac{8}{3\,(x-1)^2}+\frac{8}{3(x-1)^3}-\frac{12}{(x-1)^4}-\frac{100}{3(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\,(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+$$
$$\frac{50\,d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,0,1;\alpha_0)+\Big(-\frac{4\,d_1}{(x-1)^5}+4d_1+\frac{12}{(x-1)^5}-12\Big)H(0;\alpha_0)\;H(0,0,1;x)+\Big(-\frac{\alpha_0^4}{x-1}+$$
$$\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\,\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\,\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\,\alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\,\alpha_0}{(x-1)^4}-16\alpha_0+$$
$$\Big(\frac{8}{(x-1)^5}-8\Big)\,H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{3}{2\,(x-1)}-\frac{1}{3(x-1)^2}-\frac{1}{3(x-1)^3}+\frac{3}{2\,(x-1)^4}+\frac{25}{6(x-1)^5}+$$
$$\frac{25}{6}\Big)\,H(0,0,c_1(\alpha_0);x)+\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\,(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50\,d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,1,0;\alpha_0)+\Big(-$$
$$\frac{5\,d_1}{2(x-1)}+\frac{5d_1}{3(x-1)^2}-\frac{5d_1}{3(x-1)^3}+\frac{5\,d_1}{2(x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{25d_1}{6}-\frac{5}{2\,(x-1)}+\frac{5}{3(x-1)^2}-\frac{5}{3(x-1)^3}+\frac{5}{2\,(x-1)^4}-\frac{25}{6(x-1)^5}+$$
$$\frac{25}{6}\Big)\,H(0,1,0;x)+\Big(\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2\,d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{25d_1^2}{3}\Big)H(0,1,1;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4\,d_1^2-$$
$$\frac{10d_1}{(x-1)^5}+2d_1+\frac{14}{(x-1)^5}+2\Big)H(0;\alpha_0)\;H(0,1,1;x)+\Big(\frac{5d_1}{2(x-1)}-\frac{5d_1}{3(x-1)^2}+\frac{5\,d_1}{3(x-1)^3}-\frac{5d_1}{2(x-1)^4}+\frac{25d_1}{6\,(x-1)^5}-\frac{25d_1}{6}+$$
$$\Big(-\frac{8d_1}{(x-1)^5}+8\,d_1+\frac{8}{(x-1)^5}-8\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+4\,d_1^2+\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{5}{2\,(x-1)}-\frac{5}{3(x-1)^2}+$$
$$\frac{5}{3(x-1)^3}-\frac{5}{2\,(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)\;H(0,1,c_1(\alpha_0);x)+\Big(\frac{5\alpha_0^4}{2(x-1)}-\frac{5\,\alpha_0^4}{2}-\frac{10\alpha_0^3}{x-1}+\frac{10\alpha_0^3}{3(x-1)^2}+\frac{40\,\alpha_0^3}{3}+\frac{15\alpha_0^2}{x-1}-$$
$$\frac{10\alpha_0^2}{(x-1)^2}+\frac{5\,\alpha_0^2}{(x-1)^3}-30\alpha_0^2-\frac{10\alpha_0}{x-1}+\frac{10\,\alpha_0}{(x-1)^2}-\frac{10\alpha_0}{(x-1)^3}+\frac{10\alpha_0}{(x-1)^4}+40\,\alpha_0+\Big(\frac{4}{(x-1)^5}-20\Big)H(0;\alpha_0)+\Big(\frac{2\,d_1}{(x-1)^5}-$$
$$10d_1\Big)H(1;\alpha_0)+\frac{3}{4(x-1)}-\frac{1}{6\,(x-1)^2}-\frac{1}{6(x-1)^3}+\frac{3}{4(x-1)^4}+\frac{25}{12\,(x-1)^5}+\frac{25}{12}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8\,d_1}{x-1}-$$

$$\frac{4d_1}{(x-1)^2}+\frac{8d_1}{3(x-1)^3}-\frac{2\ d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}+\frac{5}{x-1}-\frac{10}{3\ (x-1)^2}+\frac{10}{3(x-1)^3}-\frac{5}{(x-1)^4}+\frac{25}{3(x-1)^5}-\ \frac{25}{3}\Big)H(1,0,0;x)+$$
$$\Big(\frac{4d_1^2}{(x-1)^5}-\frac{10\ d_1}{(x-1)^5}-2d_1+\frac{10}{(x-1)^5}-2\Big)H(0;\alpha_0)\ H(1,0,1;x)+\Big(\frac{2d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3\ (x-1)^3}-\frac{d_1}{2(x-1)^4}+$$
$$\frac{25d_1}{6(x-1)^5}+\Big(-\frac{8\ d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+4\Big)H(0;\alpha_0)+\Big(-\frac{4\ d_1^2}{(x-1)^5}+\frac{6d_1}{(x-1)^5}+2d_1\Big)H(1;\alpha_0)-\frac{13}{4\ (x-1)}+\frac{1}{6(x-1)^2}+$$
$$\frac{11}{6(x-1)^3}-\frac{23}{4(x-1)^4}-\ \frac{125}{12(x-1)^5}-\frac{175}{12}\Big)\ H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{x-1}+\frac{2\ d_1^2}{(x-1)^2}-\frac{4d_1^2}{3\ (x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}-$$
$$\frac{9\ d_1}{2(x-1)}+\frac{8d_1}{3(x-1)^2}-\frac{7d_1}{3(x-1)^3}+\frac{3\ d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{6}+\frac{13}{4\ (x-1)}-\frac{1}{6(x-1)^2}-\frac{11}{6(x-1)^3}+\frac{23}{4(x-1)^4}+\ \frac{125}{12(x-1)^5}+$$
$$\frac{175}{12}\Big)H(1,1,0;x)+\Big(\frac{12\ d_1^2}{(x-1)^5}-4d_1^2-\frac{18d_1}{(x-1)^5}-4\ d_1+\frac{7}{(x-1)^5}+5\Big)H(0;\alpha_0)H(1,1,1;x)+\Big(\frac{4\ d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+$$
$$\frac{4d_1^2}{3\ (x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{9\ d_1}{2(x-1)}-\frac{8d_1}{3(x-1)^2}+\frac{7d_1}{3(x-1)^3}-\frac{3\ d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}-\frac{25\ d_1}{6}+\Big(-\frac{16d_1}{(x-1)^5}+8d_1+$$
$$\frac{12}{(x-1)^5}+4\Big)\ H(0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{6\ d_1}{(x-1)^5}+2d_1\Big)H(1;\alpha_0)-\frac{13}{4(x-1)}+\frac{1}{6\ (x-1)^2}+\frac{11}{6(x-1)^3}-\frac{23}{4(x-1)^4}-$$
$$\frac{125}{12\ (x-1)^5}-\frac{175}{12}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{10\ d_1}{x-1}+\frac{5d_1}{(x-1)^2}-\frac{10d_1}{3(x-1)^3}+\frac{5\ d_1}{2(x-1)^4}-\frac{125d_1}{6(x-1)^5}+\Big(\frac{8d_1}{(x-1)^5}+\ \frac{4}{(x-1)^5}-$$
$$20\Big)H(0;\alpha_0)+\Big(\frac{4\ d_1^2}{(x-1)^5}+\frac{2d_1}{(x-1)^5}-10d_1\Big)H(1;\alpha_0)-\frac{7}{4\ (x-1)}+\frac{19}{6(x-1)^2}-\frac{31}{6(x-1)^3}+\frac{43}{4\ (x-1)^4}+\frac{25}{12(x-1)^5}+$$
$$\frac{275}{12}\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3\alpha_0^4}{2(x-1)}-\frac{3\ \alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{(x-1)^2}+8\alpha_0^3+\frac{9\ \alpha_0^2}{x-1}-\frac{6\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-$$
$$\frac{6\alpha_0}{x-1}+\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+\frac{6\ \alpha_0}{(x-1)^4}+24\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\ \ H(1;\alpha_0)}{(x-1)^5}-\frac{9}{2\ (x-1)}+\frac{1}{(x-1)^2}+\frac{1}{(x-1)^3}-\frac{9}{2\ (x-1)^4}-$$
$$\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(-\frac{19\alpha_0^4}{4(x-1)}+\frac{19\ \alpha_0^4}{4}+\frac{19\alpha_0^3}{x-1}-\frac{19\alpha_0^3}{3(x-1)^2}-\frac{76\ \alpha_0^3}{3}-\frac{57\alpha_0^2}{2(x-1)}+\frac{19\alpha_0^2}{(x-1)^2}-$$
$$\frac{19\ \alpha_0^2}{2(x-1)^3}+57\alpha_0^2+\frac{19\alpha_0}{x-1}-\frac{19\alpha_0}{(x-1)^2}+\ \frac{19\alpha_0}{(x-1)^3}-\frac{19\alpha_0}{(x-1)^4}-76\alpha_0-\frac{20\ \ H(0;\alpha_0)}{(x-1)^5}-\frac{10d_1H(1;\alpha_0)}{(x-1)^5}+\frac{57}{4\ (x-1)}-\frac{19}{6(x-1)^2}-$$
$$\frac{19}{6(x-1)^3}+\frac{57}{4\ (x-1)^4}+\frac{475}{12(x-1)^5}+\frac{475}{12}\Big)\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\frac{128}{3}\ H(0,0,0,0;x)+\Big(\frac{12}{(x-1)^5}-$$
$$12\Big)\ H(0,0,0,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4\ d_1-\frac{12}{(x-1)^5}+12\Big)H(0,0,1,0;x)+\Big(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{12}{(x-1)^5}-$$
$$12\Big)\ H(0,0,1,c_1(\alpha_0);x)+\Big(-10-\frac{6}{(x-1)^5}\Big)\ H(0,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8d_1}{(x-1)^5}-8\ d_1-\frac{8}{(x-1)^5}+$$
$$8\Big)H(0,1,0,0;x)+\Big(-\frac{6\ d_1}{(x-1)^5}-2d_1+\frac{14}{(x-1)^5}+2\Big)\ H(0,1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{10\ d_1}{(x-1)^5}-$$
$$2d_1-\frac{14}{(x-1)^5}-2\Big)\ H(0,1,1,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\frac{10\ d_1}{(x-1)^5}+2d_1+\frac{14}{(x-1)^5}+2\Big)\ H(0,1,1,c_1(\alpha_0);x)+$$
$$\Big(-\frac{2d_1}{(x-1)^5}+10\ d_1-\frac{6}{(x-1)^5}-10\Big)\ H(0,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(6+\frac{2}{(x-1)^5}\Big)\ H(0,c_1(\alpha_0),0,c_1(\alpha_0);x)+$$
$$\Big(-19-\frac{1}{(x-1)^5}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(16-\frac{16}{(x-1)^5}\Big)\ H(1,0,0,0;x)+\Big(-\frac{4d_1}{(x-1)^5}+\frac{10}{(x-1)^5}-$$
$$2\Big)\ H(1,0,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{10\ d_1}{(x-1)^5}+2d_1-\frac{10}{(x-1)^5}+2\Big)\ H(1,0,1,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{10d_1}{(x-1)^5}-$$
$$2\ d_1+\frac{10}{(x-1)^5}-2\Big)H(1,0,1,c_1(\alpha_0);x)+\Big(-\frac{2\ d_1}{(x-1)^5}+\frac{5}{(x-1)^5}-1\Big)\ H(1,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{16d_1}{(x-1)^5}-$$
$$8\ d_1-\frac{12}{(x-1)^5}-4\Big)H(1,1,0,0;x)+\Big(\frac{4\ d_1^2}{(x-1)^5}-\frac{12d_1}{(x-1)^5}-2d_1+\frac{7}{(x-1)^5}+5\Big)\ H(1,1,0,c_1(\alpha_0);x)+\Big(-$$
$$\frac{12d_1^2}{(x-1)^5}+4d_1^2+\frac{18\ d_1}{(x-1)^5}+4d_1-\frac{7}{(x-1)^5}-5\Big)\ H(1,1,1,0;x)+\Big(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{18\ d_1}{(x-1)^5}-4d_1+\frac{7}{(x-1)^5}+$$
$$5\Big)\ H(1,1,1,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}-\frac{4\ d_1}{(x-1)^5}+10d_1+\frac{5}{(x-1)^5}-1\Big)\ H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-$$
$$\frac{4\ d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+6\Big)\ H(1,c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(\frac{10\ d_1}{(x-1)^5}-\frac{1}{(x-1)^5}-19\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-$$
$$\frac{4\ H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{10\ H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{6\ H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-$$
$$\frac{19\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+H(0;x)\ \Big(-\frac{63d_1^2}{16(x-1)}+\frac{19d_1^2}{54(x-1)^2}+\frac{19\ d_1^2}{54(x-1)^3}-\frac{63d_1^2}{16(x-1)^4}-\frac{2035d_1^2}{432\ (x-1)^5}-$$
$$\frac{2035d_1^2}{432}+\frac{407d_1}{48(x-1)}-\frac{80\ d_1}{27(x-1)^2}-\frac{73d_1}{54(x-1)^3}+\frac{1171d_1}{48\ (x-1)^4}+\frac{15865d_1}{432(x-1)^5}+\frac{9685d_1}{432}+\frac{5\ \pi^2}{8(x-1)}+\frac{37}{8(x-1)}-\frac{5\pi^2}{36\ (x-1)^2}+$$
$$\frac{101}{108(x-1)^2}-\frac{5\pi^2}{36\ (x-1)^3}+\frac{365}{108(x-1)^3}+\frac{5\pi^2}{8\ (x-1)^4}-\frac{239}{8(x-1)^4}+\frac{125\pi^2}{72\ (x-1)^5}-\frac{13505}{216(x-1)^5}+\frac{12\zeta_3}{(x-1)^5}+24\ \zeta_3+\frac{125\pi^2}{72}-$$

$$\frac{5525}{216}\Big) + H(1;x) \Big(- \frac{\pi^2 d_1}{3(x-1)} + \frac{\pi^2 d_1}{6\ (x-1)^2} - \frac{\pi^2 d_1}{9(x-1)^3} + \frac{\pi^2 d_1}{12\ (x-1)^4} - \frac{25\pi^2 d_1}{36(x-1)^5} - \frac{6\zeta_3\ d_1}{(x-1)^5} + \Big(- \frac{4d_1^2}{x-1} + \frac{d_1^2}{(x-1)^2} -$$
$$\frac{4\ d_1^2}{9(x-1)^3} + \frac{d_1^2}{4(x-1)^4} - \frac{205 d_1^2}{36\ (x-1)^5} + \frac{193 d_1}{24(x-1)} - \frac{265 d_1}{36(x-1)^2} + \frac{25\ d_1}{4(x-1)^3} - \frac{107 d_1}{24(x-1)^4} + \frac{185 d_1}{8(x-1)^5} + \frac{205 d_1}{72} + \frac{133}{8(x-1)} -$$
$$\frac{289}{36\ (x-1)^2} + \frac{289}{36(x-1)^3} - \frac{133}{8(x-1)^4} - \frac{\pi^2}{6\ (x-1)^5} + \frac{305}{72(x-1)^5} + \frac{\pi^2}{6} - \frac{305}{72}\Big) H(0;\alpha_0) + \Big(- \frac{8d_1}{x-1} + \frac{4d_1}{(x-1)^2} - \frac{8d_1}{3\ (x-1)^3} +$$
$$\frac{2d_1}{(x-1)^4} - \frac{50 d_1}{3\ (x-1)^5} - \frac{5}{x-1} + \frac{10}{3(x-1)^2} - \frac{10}{3\ (x-1)^3} + \frac{5}{(x-1)^4} - \frac{25}{3(x-1)^5} + \frac{25}{3}\Big) H(0,0;\alpha_0) + \Big(- \frac{4d_1^2}{x-1} + \frac{2d_1^2}{(x-1)^2} -$$
$$\frac{4\ d_1^2}{3(x-1)^3} + \frac{d_1^2}{(x-1)^4} - \frac{25 d_1^2}{3\ (x-1)^5} - \frac{5d_1}{2(x-1)} + \frac{5d_1}{3(x-1)^2} - \frac{5d_1}{3\ (x-1)^3} + \frac{5d_1}{2(x-1)^4} - \frac{25 d_1}{6(x-1)^5} + \frac{25\ d_1}{6}\Big) H(0,1;\alpha_0) +$$
$$\Big(\frac{16}{(x-1)^5} - 16\Big) H(0,0,0;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(0,0,1;\alpha_0) + \Big(\frac{8\ d_1}{(x-1)^5} - 8d_1\Big) H(0,1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} -$$
$$4\ d_1^2\Big) H(0,1,1;\alpha_0) + \frac{13\pi^2}{24(x-1)} - \frac{\pi^2}{36\ (x-1)^2} - \frac{11\pi^2}{36(x-1)^3} + \frac{23\pi^2}{24\ (x-1)^4} + \frac{125\pi^2}{72(x-1)^5} - \frac{\zeta_3}{(x-1)^5} + 13\ \zeta_3 + \frac{175\pi^2}{72}\Big) +$$
$$\frac{5 d_1 \pi^2}{16\ (x-1)} - \frac{71\pi^2}{48(x-1)} - \frac{5 d_1 \pi^2}{108\ (x-1)^2} + \frac{4\pi^2}{27(x-1)^2} - \frac{5 d_1 \pi^2}{108\ (x-1)^3} + \frac{\pi^2}{27(x-1)^3} + \frac{5 d_1 \pi^2}{16\ (x-1)^4} + \frac{17\pi^2}{48(x-1)^4} - \frac{61\pi^4}{180\ (x-1)^5} +$$
$$\frac{205 d_1 \pi^2}{432(x-1)^5} - \frac{305\pi^2}{432\ (x-1)^5} - \frac{39\zeta_3}{4(x-1)} + \frac{13\zeta_3}{6\ (x-1)^2} + \frac{13\zeta_3}{6(x-1)^3} - \frac{39\zeta_3}{4\ (x-1)^4} - \frac{325\zeta_3}{12(x-1)^5} - \frac{325\ \zeta_3}{12} - \frac{49\pi^4}{432} + \frac{205 d_1 \pi^{\ 2}}{432} - \frac{1145\pi^2}{432}.$$

E. The $\mathcal{B}$-type collinear integrals

E.1 The $\mathcal{B}$ integral for $k = 0$ and $\delta = -1$

The ε expansion for this integral reads

$$\begin{aligned} \mathcal{I}(x,\varepsilon;\alpha_0, 3+d_1\varepsilon; 1, 0, -1, g_B) &= x\, \mathcal{B}(\varepsilon, x; 3+d_1\varepsilon; -1, 0) \\ &= \frac{1}{\varepsilon} b_{-1}^{(-1,0)} + b_0^{(-1,0)} + \varepsilon b_1^{(-1,0)} + \varepsilon^2 b_2^{(-1,0)} + \mathcal{O}\left(\varepsilon^3\right), \end{aligned} \tag{E.1}$$

where

$$b_{-1}^{(-1,0)} = -\frac{1}{2},$$

$$b_0^{(-1,0)} = \frac{\alpha_0^4}{4\ (x-1)} + \frac{\alpha_0^4}{4} - \frac{\alpha_0^3}{x-1} + \frac{\alpha_0^3}{3\ (x-1)^2} - \frac{4\alpha_0^3}{3} + \frac{3\alpha_0^2}{2\ (x-1)} - \frac{\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{2(x-1)^3} + 3\ \alpha_0^2 - \frac{\alpha_0}{x-1} +$$
$$\frac{\alpha_0}{(x-1)^2} - \frac{\alpha_0}{(x-1)^3} + \frac{\alpha_0}{(x-1)^4} - 4\alpha_0 + \Big(1 + \frac{1}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(1 - \frac{1}{(x-1)^5}\Big) H(0;x) + \frac{H(c_1(\alpha_0);x)}{(x-1)^5} - 1,$$

$$b_1^{(-1,0)} = -\frac{d_1\alpha_0^4}{8} - \frac{d_1\alpha_0^4}{8(x-1)} + \frac{3\alpha_0^4}{4\ (x-1)} + \frac{3\alpha_0^4}{4} + \frac{13 d_1\alpha_0^3}{18} + \frac{d_1\alpha_0^3}{2\ (x-1)} - \frac{3\alpha_0^3}{x-1} - \frac{2d_1\alpha_0^3}{9(x-1)^2} + \frac{23\ \alpha_0^3}{18(x-1)^2} - \frac{77\alpha_0^3}{18} -$$
$$\frac{23 d_1\ \alpha_0^2}{12} - \frac{3d_1\alpha_0^2}{4(x-1)} + \frac{53\alpha_0^2}{12\ (x-1)} + \frac{2d_1\alpha_0^2}{3(x-1)^2} - \frac{47\alpha_0^2}{12\ (x-1)^2} - \frac{d_1\alpha_0^2}{2(x-1)^3} + \frac{31\alpha_0^2}{12\ (x-1)^3} + \frac{131\alpha_0^2}{12} + \frac{25 d_1\alpha_0}{6} + \frac{d_1\alpha_0}{2\ (x-1)} -$$
$$\frac{7\alpha_0}{3(x-1)} - \frac{2d_1\alpha_0}{3(x-1)^2} + \frac{4\ \alpha_0}{(x-1)^2} + \frac{d_1\alpha_0}{(x-1)^3} - \frac{17\alpha_0}{3\ (x-1)^3} - \frac{2d_1\alpha_0}{(x-1)^4} + \frac{49\alpha_0}{6(x-1)^4} - \frac{121\ \alpha_0}{6} + \Big(- \frac{\alpha_0^4}{x-1} - \alpha_0^4 + \frac{4\alpha_0^3}{x-1} -$$
$$\frac{4\ \alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-1} + \frac{4\ \alpha_0^2}{(x-1)^2} - \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 + \frac{4\ \alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\ \alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{5}{2(x-1)} +$$
$$\frac{5}{3(x-1)^2} - \frac{5}{3\ (x-1)^3} + \frac{5}{2(x-1)^4} + \frac{37}{6(x-1)^5} - \frac{13}{6}\Big) H(0;\alpha_0) + \Big(\frac{37}{6} + \frac{5}{2(x-1)} - \frac{5}{3\ (x-1)^2} + \frac{5}{3(x-1)^3} - \frac{5}{2(x-1)^4} -$$
$$\frac{37}{6(x-1)^5}\Big) H(0;x) + \Big(- \frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2\ (x-1)} + \frac{8d_1\alpha_0^3}{3} + \frac{2d_1\alpha_0^3}{x-1} - \frac{2d_1\ \alpha_0^3}{3(x-1)^2} - 6d_1\alpha_0^2 - \frac{3d_1\alpha_0^2}{x-1} + \frac{2d_1\ \alpha_0^2}{(x-1)^2} - \frac{d_1\alpha_0^2}{(x-1)^3} +$$
$$8d_1\alpha_0 + \frac{2d_1\ \alpha_0}{x-1} - \frac{2d_1\alpha_0}{(x-1)^2} + \frac{2d_1\alpha_0}{(x-1)^3} - \frac{2\ d_1\alpha_0}{(x-1)^4} - \frac{25 d_1}{6} - \frac{d_1}{2(x-1)} + \frac{2d_1}{3\ (x-1)^2} - \frac{d_1}{(x-1)^3} + \frac{2d_1}{(x-1)^4}\Big) H(1;\alpha_0) +$$
$$\Big(\frac{2d_1}{(x-1)^5} - \frac{2}{(x-1)^5} + 2\Big) H(0;\alpha_0)\ H(1;x) + \Big(- \frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} + \frac{2\ \alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} - \frac{3\ \alpha_0^2}{x-1} + \frac{2\alpha_0^2}{(x-1)^2} -$$
$$\frac{\alpha_0^2}{(x-1)^3} - 6\ \alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\ \alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{4H(0;\alpha_0)}{(x-1)^5} - \frac{2d_1 H(1;\alpha_0)}{(x-1)^5} - \frac{5}{2(x-1)} + \frac{5}{3(x-1)^2} -$$
$$\frac{5}{3(x-1)^3} + \frac{5}{2(x-1)^4} + \frac{37}{6\ (x-1)^5} - \frac{25}{6}\Big) H(c_1(\alpha_0);x) + \Big(- 4 - \frac{4}{(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(\frac{4}{(x-1)^5} -$$
$$4\Big) H(0,0;x) + \Big(- \frac{2\ d_1}{(x-1)^5} - 2d_1\Big) H(0,1;\alpha_0) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,c_1(\alpha_0);x) + \Big(- \frac{2d_1}{(x-1)^5} + \frac{2}{(x-1)^5} -$$
$$2\Big)\ H(1,0;x) + \Big(\frac{2d_1}{(x-1)^5} - \frac{2}{(x-1)^5} + 2\Big) H(1,c_1(\ \alpha_0);x) - \frac{2H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} + \frac{\pi^2}{3\ (x-1)^5} - \frac{\pi^2}{3} - 2,$$

$$b_2^{(-1,0)} =$$

$$\frac{d_1^2\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{16\ (x-1)}-\frac{d_1\alpha_0^4}{2(x-1)}-\frac{\pi^2\alpha_0^4}{24\ (x-1)}+\frac{7\alpha_0^4}{4(x-1)}-\frac{\pi^2\alpha_0^4}{24}+\frac{7\ \alpha_0^4}{4}-\frac{43d_1^2\alpha_0^3}{108}+\frac{349d_1\ \alpha_0^3}{108}-\frac{d_1^2\alpha_0^3}{4(x-1)}+\frac{2d_1\ \alpha_0^3}{x-1}+$$

$$\frac{\pi^2\alpha_0^3}{6(x-1)}-\frac{7\alpha_0^3}{x-1}+\frac{4\ d_1^2\alpha_0^3}{27(x-1)^2}-\frac{133d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi\ ^2\alpha_0^3}{18(x-1)^2}+\frac{191\alpha_0^3}{54(x-1)^2}+\frac{2\pi^2\ \alpha_0^3}{9}-\frac{569\alpha_0^3}{54}+\frac{95d_1^2\alpha_0^2}{72}-\frac{85d_1\ \alpha_0^2}{8}+\frac{3d_1^2\alpha_0^2}{8(x-1)}-$$

$$\frac{203d_1\alpha_0^2}{72\ (x-1)}-\frac{\pi^2\alpha_0^2}{4(x-1)}+\frac{353\alpha_0^2}{36\ (x-1)}-\frac{4d_1^2\alpha_0^2}{9(x-1)^2}+\frac{31d_1\alpha_0^2}{8\ (x-1)^2}+\frac{\pi^2\alpha_0^2}{6(x-1)^2}-\frac{407\alpha_0^2}{36(x-1)^2}+\frac{d_1^2\alpha_0^2}{2(x-1)^3}-\frac{283d_1\alpha_0^2}{72(x-1)^3}-\frac{\pi^2\alpha_0^2}{12(x-1)^3}+$$

$$\frac{331\alpha_0^2}{36(x-1)^3}-\frac{\pi^2\ \alpha_0^2}{2}+\frac{1091\alpha_0^2}{36}-\frac{205d_1^2\alpha_0}{36}+\frac{475\ d_1\alpha_0}{12}+\frac{2\alpha_0}{3(x-2)}-\frac{d_1^2\alpha_0}{4\ (x-1)}-\frac{d_1\alpha_0}{9(x-1)}+\frac{\pi^2\alpha_0}{6(x-1)}-\frac{13\ \alpha_0}{36(x-1)}+\frac{4d_1^2\alpha_0}{9(x-1)^2}-$$

$$\frac{73d_1\alpha_0}{18\ (x-1)^2}-\frac{\pi^2\alpha_0}{6(x-1)^2}+\frac{35\alpha_0}{3\ (x-1)^2}-\frac{d_1^2\alpha_0}{(x-1)^3}+\frac{173d_1\alpha_0}{18\ (x-1)^3}+\frac{\pi^2\alpha_0}{6(x-1)^3}-\frac{875\alpha_0}{36\ (x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}-\frac{937d_1\alpha_0}{36\ (x-1)^4}-\frac{\pi^2\alpha_0}{6(x-1)^4}+$$

$$\frac{413\alpha_0}{9\ (x-1)^4}+\frac{2\pi^2\alpha_0}{3}-\frac{737\alpha_0}{9}+\Bigg(\frac{d_1\ \alpha_0^4}{2}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{x-1}-3\ \alpha_0^4-\frac{26d_1\alpha_0^3}{9}-\frac{2d_1\alpha_0^3}{x-1}+\frac{12\ \alpha_0^3}{x-1}+\frac{8d_1\alpha_0^3}{9(x-1)^2}-\frac{46\alpha_0^3}{9(x-1)^2}+$$

$$\frac{154\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}+\frac{3d_1\ \alpha_0^2}{x-1}-\frac{53\alpha_0^2}{3(x-1)}-\frac{8d_1\alpha_0^2}{3\ (x-1)^2}+\frac{47\alpha_0^2}{3(x-1)^2}+\frac{2d_1\ \alpha_0^2}{(x-1)^3}-\frac{31\alpha_0^2}{3(x-1)^3}-\frac{131\ \alpha_0^2}{3}-\frac{50d_1\alpha_0}{3}-\frac{2d_1\alpha_0}{x-1}+\frac{28\alpha_0}{3\ (x-1)}+$$

$$\frac{8d_1\alpha_0}{3(x-1)^2}-\frac{16\alpha_0}{(x-1)^2}-\frac{4d_1\ \alpha_0}{(x-1)^3}+\frac{68\alpha_0}{3(x-1)^3}+\frac{8d_1\ \alpha_0}{(x-1)^4}-\frac{98\alpha_0}{3(x-1)^4}+\frac{242\alpha_0}{3}+\frac{205\ d_1}{36}-\frac{4}{x-2}+\frac{17d_1}{4(x-1)}-\frac{53}{4\ (x-1)}+\frac{8}{3(x-2)^2}-$$

$$\frac{13d_1}{9(x-1)^2}+\frac{317}{36\ (x-1)^2}+\frac{13d_1}{9(x-1)^3}-\frac{371}{36(x-1)^3}-\frac{17\ d_1}{4(x-1)^4}+\frac{193}{12(x-1)^4}-\frac{205d_1}{36\ (x-1)^5}-\frac{\pi^2}{6(x-1)^5}+\frac{266}{9(x-1)^5}-\frac{\pi\ ^2}{6}-$$

$$\frac{194}{9}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{17d_1}{4\ (x-1)}+\frac{13d_1}{9(x-1)^2}-\frac{13d_1}{9(x-1)^3}+\frac{17\ d_1}{4(x-1)^4}+\frac{205d_1}{36(x-1)^5}-\frac{205\ d_1}{36}+\frac{4}{x-2}+\frac{53}{4(x-1)}-\frac{8}{3\ (x-2)^2}-$$

$$\frac{317}{36(x-1)^2}+\frac{371}{36(x-1)^3}-\frac{193}{12\ (x-1)^4}-\frac{7\pi^2}{6(x-1)^5}-\frac{266}{9(x-1)^5}+\frac{3\pi\ ^2}{2}+\frac{266}{9}\Bigg)H(0;x)+\Bigg(\frac{d_1^2\alpha_0^4}{4}-\frac{3\ d_1\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{4(x-1)}-$$

$$\frac{3d_1\alpha_0^4}{2\ (x-1)}-\frac{13d_1^2\alpha_0^3}{9}+\frac{77d_1\alpha_0^3}{9}-\frac{d_1^2\ \alpha_0^3}{x-1}+\frac{6d_1\alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{9\ (x-1)^2}-\frac{23d_1\alpha_0^3}{9(x-1)^2}+\frac{23d_1^2\ \alpha_0^2}{6}-\frac{131d_1\alpha_0^2}{6}+\frac{3d_1^2\alpha_0^2}{2\ (x-1)}-\frac{53d_1\alpha_0^2}{6(x-1)}-$$

$$\frac{4d_1^2\alpha_0^2}{3\ (x-1)^2}+\frac{47d_1\alpha_0^2}{6(x-1)^2}+\frac{d_1^2\ \alpha_0^2}{(x-1)^3}-\frac{31d_1\alpha_0^2}{6(x-1)^3}-\frac{25d_1^2\ \alpha_0}{3}+\frac{121d_1\alpha_0}{3}-\frac{d_1^2\alpha_0}{x-1}+\frac{14d_1\ \alpha_0}{3(x-1)}+\frac{4d_1^2\alpha_0}{3(x-1)^2}-\frac{8d_1\ \alpha_0}{(x-1)^2}-\frac{2d_1^2\alpha_0}{(x-1)^3}+$$

$$\frac{34d_1\alpha_0}{3\ (x-1)^3}+\frac{4d_1^2\alpha_0}{(x-1)^4}-\frac{49d_1\alpha_0}{3\ (x-1)^4}+\frac{205d_1^2}{36}-\frac{230d_1}{9}+\frac{d_1^2}{4\ (x-1)}-\frac{d_1}{3(x-1)}-\frac{4d_1^2}{9(x-1)^2}+\frac{49d_1}{18\ (x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{37d_1}{6(x-1)^3}-$$

$$\frac{4\ d_1^2}{(x-1)^4}+\frac{49d_1}{3(x-1)^4}\Bigg)H(1;\alpha_0)+\Bigg(\frac{\pi\ ^2}{2(x-1)^5}-\frac{\pi^2}{2}\Bigg)H(2;x)+\Bigg(\frac{4\ \alpha_0^4}{x-1}+4\alpha_0^4-\frac{16\alpha_0^3}{x-1}+\frac{16\alpha_0^3}{3\ (x-1)^2}-\frac{64\alpha_0^3}{3}+\frac{24\alpha_0^2}{x-1}-$$

$$\frac{16\ \alpha_0^2}{(x-1)^2}+\frac{8\alpha_0^2}{(x-1)^3}+48\alpha_0^2-\frac{16\ \alpha_0}{x-1}+\frac{16\alpha_0}{(x-1)^2}-\frac{16\alpha_0}{(x-1)^3}+\frac{16\ \alpha_0}{(x-1)^4}-64\alpha_0+\frac{10}{x-1}-\frac{20}{3(x-1)^2}+\frac{20}{3\ (x-1)^3}-\frac{10}{(x-1)^4}-$$

$$\frac{74}{3(x-1)^5}+\frac{26}{3}\Bigg)\ H(0,0;\alpha_0)+\Bigg(-\frac{74}{3}-\frac{10}{x-1}+\frac{20}{3\ (x-1)^2}-\frac{20}{3(x-1)^3}+\frac{10}{(x-1)^4}+\frac{74}{3(x-1)^5}\ \Bigg)H(0,0;x)+\Bigg(2d_1\alpha_0^4+$$

$$\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\ \alpha_0^3}{3}-\frac{8d_1\alpha_0^3}{x-1}+\frac{8d_1\alpha_0^3}{3(x-1)^2}+24\ d_1\alpha_0^2+\frac{12d_1\alpha_0^2}{x-1}-\frac{8d_1\ \alpha_0^2}{(x-1)^2}+\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0-\frac{8d_1\ \alpha_0}{x-1}+\frac{8d_1\alpha_0}{(x-1)^2}-\frac{8d_1\alpha_0}{(x-1)^3}+$$

$$\frac{8\ d_1\alpha_0}{(x-1)^4}+\frac{13d_1}{3}+\frac{5d_1}{x-1}-\frac{10d_1}{3\ (x-1)^2}+\frac{10d_1}{3(x-1)^3}-\frac{5d_1}{(x-1)^4}-\frac{37\ d_1}{3(x-1)^5}\Bigg)H(0,1;\alpha_0)+H(1;x)\Bigg(\frac{2\pi^2d_1}{3\ (x-1)^5}+\Bigg(-\frac{4d_1}{x-1}+$$

$$\frac{2d_1}{(x-1)^2}-\frac{4d_1}{3\ (x-1)^3}+\frac{d_1}{(x-1)^4}+\frac{37d_1}{3\ (x-1)^5}+\frac{4}{x-2}+\frac{5}{2(x-1)}-\frac{8}{3\ (x-2)^2}-\frac{3}{(x-1)^2}+\frac{8}{3(x-2)^3}+\frac{5}{3\ (x-1)^3}-\frac{13}{2(x-1)^4}-$$

$$\frac{37}{3(x-1)^5}+\frac{37}{3}\Bigg)\ H(0;\alpha_0)+\Bigg(-\frac{8d_1}{(x-1)^5}+\frac{8}{(x-1)^5}-8\Bigg)\ H(0,0;\alpha_0)+\Bigg(-\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-4\ d_1\Bigg)H(0,1;\alpha_0)-$$

$$\frac{2\pi^2}{3(x-1)^5}+\frac{\pi^2}{3}\Bigg)+\ \ \Bigg(-\frac{4d_1}{(x-1)^5}+4d_1+\frac{8}{(x-1)^5}-8\Bigg)H(0;\alpha_0)\ H(0,1;x)+\Bigg(\Bigg(\frac{8}{(x-1)^5}-8\Bigg)H(0;\alpha_0)+$$

$$\Bigg(\frac{4\ d_1}{(x-1)^5}-4d_1\Bigg)H(1;\alpha_0)+\frac{4}{x-2}+\frac{5}{2\ (x-1)}-\frac{8}{3(x-2)^2}-\frac{3}{(x-1)^2}+\frac{8}{3\ (x-2)^3}+\frac{5}{3(x-1)^3}-\frac{13}{2(x-1)^4}-\frac{37}{3\ (x-1)^5}+$$

$$\frac{37}{3}\Bigg)H(0,c_1(\alpha_0);x)+\Bigg(2d_1\alpha_0^4+\frac{2\ d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}-\frac{8d_1\ \alpha_0^3}{x-1}+\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2+\frac{12d_1\ \alpha_0^2}{x-1}-\frac{8d_1\alpha_0^2}{(x-1)^2}+\frac{4d_1\ \alpha_0^2}{(x-1)^3}-$$

$$32d_1\alpha_0-\frac{8d_1\alpha_0}{x-1}+\frac{8d_1\ \alpha_0}{(x-1)^2}-\frac{8d_1\alpha_0}{(x-1)^3}+\frac{8d_1\ \alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{2d_1}{x-1}-\frac{8d_1}{3\ (x-1)^2}+\frac{4d_1}{(x-1)^3}-\frac{8d_1}{(x-1)^4}\Bigg)H(1,0;\alpha_0)+\ \Bigg(\frac{4d_1}{x-1}-$$

$$\frac{2d_1}{(x-1)^2}+\frac{4d_1}{3(x-1)^3}-\ \frac{d_1}{(x-1)^4}-\frac{37d_1}{3(x-1)^5}-\frac{4}{x-2}-\frac{5}{2\ (x-1)}+\frac{8}{3(x-2)^2}+\frac{3}{(x-1)^2}-\frac{8}{3\ (x-2)^3}-\frac{5}{3(x-1)^3}+\frac{13}{2(x-1)^4}+$$

$$\frac{37}{3\ (x-1)^5}-\frac{37}{3}\Bigg)H(1,0;x)+\Bigg(d_1^2\alpha_0^4+\frac{d_1^2\ \alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}-\frac{4d_1^2\ \alpha_0^3}{x-1}+\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2+\frac{6\ d_1^2\alpha_0^2}{x-1}-\frac{4d_1^2\alpha_0^2}{(x-1)^2}+\frac{2d_1^2\ \alpha_0^2}{(x-1)^3}-$$

$$16d_1^2\alpha_0-\frac{4d_1^2\alpha_0}{x-1}+\frac{4d_1^2\ \alpha_0}{(x-1)^2}-\frac{4d_1^2\alpha_0}{(x-1)^3}+\frac{4d_1^2\ \alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{d_1^2}{x-1}-\frac{4d_1^2}{3\ (x-1)^2}+\frac{2d_1^2}{(x-1)^3}-\frac{4d_1^2}{(x-1)^4}\Bigg)\ H(1,1;\alpha_0)+$$

$$H(c_1(\alpha_0);x)\Bigg(\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4\ (x-1)}-\frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{13d_1\ \alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+\frac{6\alpha_0^3}{x-1}+\frac{4d_1\ \alpha_0^3}{9(x-1)^2}-\frac{23\alpha_0^3}{9(x-1)^2}+\frac{77\ \alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{6}-$$

$$\frac{\alpha_0^2}{3(x-2)}+\frac{3d_1\ \alpha_0^2}{2(x-1)}-\frac{103\alpha_0^2}{12(x-1)}-\frac{4d_1\alpha_0^2}{3\ (x-1)^2}+\frac{95\alpha_0^2}{12(x-1)^2}+\frac{d_1\ \alpha_0^2}{(x-1)^3}-\frac{31\alpha_0^2}{6(x-1)^3}-\frac{131\ \alpha_0^2}{6}-\frac{25d_1\alpha_0}{3}+\frac{2\alpha_0}{x-2}-\frac{d_1\alpha_0}{x-1}+$$

$$\frac{10\alpha_0}{3(x-1)}-\frac{4\alpha_0}{3(x-2)^2}+\frac{4d_1\alpha_0}{3\ (x-1)^2}-\frac{15\alpha_0}{2(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{71\ \alpha_0}{6(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{49\alpha_0}{3\ (x-1)^4}+\frac{121\alpha_0}{3}+\frac{205d_1}{36}+\Bigg(\frac{2\ \alpha_0^4}{x-1}+$$

$2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3\ (x-1)^2}-\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\ \alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2-\frac{8\ \alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\ \alpha_0}{(x-1)^4}-32\alpha_0+\frac{10}{x-1}-\frac{20}{3(x-1)^2}+\frac{20}{3\ (x-1)^3}-\frac{10}{(x-1)^4}-\frac{74}{3(x-1)^5}+\frac{50}{3}\Big)\ H(0;\alpha_0)+\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\ \alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\ \alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\ \alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{3}+\frac{5d_1}{x-1}-\frac{10d_1}{3\ (x-1)^2}+\frac{10d_1}{3(x-1)^3}-\frac{5d_1}{(x-1)^4}-\frac{37\ d_1}{3(x-1)^5}\Big)H(1;\alpha_0)+\frac{16H(0,0;\alpha_0)}{(x-1)^5}+\frac{8\ d_1H(0,1;\alpha_0)}{(x-1)^5}+\frac{8d_1H(1,0;\alpha_0)}{(x-1)^5}+\frac{4\ d_1^2H(1,1;\alpha_0)}{(x-1)^5}-\frac{4}{x-2}+\frac{17d_1}{4\ (x-1)}-\frac{53}{4(x-1)}+\frac{8}{3(x-2)^2}-\frac{13d_1}{9\ (x-1)^2}+\frac{317}{36(x-1)^2}+\frac{13d_1}{9\ (x-1)^3}-\frac{371}{36(x-1)^3}-\frac{17d_1}{4\ (x-1)^4}+\frac{193}{12(x-1)^4}-\frac{205d_1}{36(x-1)^5}-\frac{\pi^{\ 2}}{6(x-1)^5}+\frac{266}{9(x-1)^5}-\frac{230}{9}\Big)+\Big(\frac{4\ d_1^2}{(x-1)^5}-\frac{8d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-2\Big)\ H(0;\alpha_0)H(1,1;x)+\Big(-\frac{4d_1}{x-1}+\frac{2\ d_1}{(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{d_1}{(x-1)^4}+\frac{37\ d_1}{3(x-1)^5}+\Big(-\frac{8d_1}{(x-1)^5}+\frac{8}{(x-1)^5}-8\Big)\ H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-4\ d_1\Big)H(1;\alpha_0)+\frac{4}{x-2}+\frac{5}{2(x-1)}-\frac{8}{3\ (x-2)^2}-\frac{3}{(x-1)^2}+\frac{8}{3(x-2)^3}+\frac{5}{3\ (x-1)^3}-\frac{13}{2(x-1)^4}-\frac{37}{3(x-1)^5}+\frac{37}{3}\Big)\ H(1,c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)H(0;\alpha_0)H(2,1;x)+\Big(\ \frac{\alpha_0^4}{x-1}+\frac{3\alpha_0^4}{2}-\frac{4\alpha_0^3}{x-1}+\frac{4\ \alpha_0^3}{3(x-1)^2}-8\alpha_0^3+\frac{6\alpha_0^2}{x-1}-\frac{4\ \alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}+18\alpha_0^2-\frac{4\ \alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\ \alpha_0}{(x-1)^4}-24\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\ H(1;\alpha_0)}{(x-1)^5}+\frac{7}{x-1}-\frac{13}{3\ (x-1)^2}+\frac{4}{(x-1)^3}-\frac{11}{2(x-1)^4}-\frac{37}{3(x-1)^5}+\ \frac{25}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{2\ (x-1)}-\frac{\alpha_0^4}{2}-\frac{2\alpha_0^3}{x-1}+\frac{2\alpha_0^3}{3(x-1)^2}+\ \frac{8\alpha_0^3}{3}+\frac{3\alpha_0^2}{x-1}-\frac{2\ \alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{(x-1)^3}-6\alpha_0^2-\frac{2\ \alpha_0}{x-1}+\frac{2\alpha_0}{(x-1)^2}-\frac{2\alpha_0}{(x-1)^3}+\frac{2\ \alpha_0}{(x-1)^4}+8\alpha_0-\frac{4}{x-2}+\frac{1}{2(x-1)}+\frac{8}{3\ (x-2)^2}+\frac{2}{3(x-1)^2}-\frac{8}{3\ (x-2)^3}+\frac{1}{(x-1)^3}+\frac{2}{(x-1)^4}-\frac{25}{6}\Big)H(c_2(\ \alpha_0),c_1(\alpha_0);x)+\Big(16+\frac{16}{(x-1)^5}\Big)\ H(0,0,0;\alpha_0)+\Big(16-\frac{16}{(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{8\ d_1}{(x-1)^5}+8d_1\Big)H(0,0,1;\alpha_0)+\Big(\frac{8}{(x-1)^5}-8\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(\frac{8d_1}{(x-1)^5}+8d_1\Big)H(0,1,0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1-\frac{8}{(x-1)^5}+8\Big)H(0,1,0;x)+\ \Big(\frac{4d_1^2}{(x-1)^5}+4d_1^2\Big)H(0,1,1;\alpha_0)+\Big(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{8}{(x-1)^5}-8\Big)\ H(0,1,c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-6\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)\ H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8\ d_1}{(x-1)^5}-\frac{8}{(x-1)^5}+8\Big)H(1,0,0;x)+\Big(-\frac{4\ d_1}{(x-1)^5}+\frac{4}{(x-1)^5}-2\Big)\ H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{8\ d_1}{(x-1)^5}-4d_1-\frac{4}{(x-1)^5}+2\Big)H(1,1,0;x)+\Big(\frac{4\ d_1^2}{(x-1)^5}-\frac{8d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-2\Big)\ H(1,1,c_1(\alpha_0);x)+\Big(-\frac{4\ d_1}{(x-1)^5}+\frac{4}{(x-1)^5}-6\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)\ H(2,0,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)\ H(2,1,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big)\ H(2,1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)\ H(2,c_2(\alpha_0),c_1(\alpha_0);x)+\frac{4\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{2\ H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{x-2}-\frac{3\ \pi^2}{8(x-1)}+\frac{2\pi^2}{3(x-2)^2}+\frac{5\pi^2}{9\ (x-1)^2}-\frac{2\pi^2}{3(x-2)^3}-\frac{7\pi^2}{36\ (x-1)^3}+\frac{5\pi^2}{4(x-1)^4}+\frac{37\pi^2}{18\ (x-1)^5}-\frac{21\zeta_3}{4(x-1)^5}+\frac{17\zeta_3}{4}+\frac{\pi^{\ 2}\ln 2}{2(x-1)^5}-\frac{1}{2}\pi^2\ln 2\ -\frac{173\pi^{\ 2}}{72}-4.$

E.2 The $\mathcal{B}$ integral for $k=1$ and $\delta=-1$

The ε expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,1,-1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,1)\\ &= \frac{1}{\varepsilon}b_{-1}^{(-1,1)}+b_0^{(-1,1)}+\varepsilon b_1^{(-1,1)}+\varepsilon^2 b_2^{(-1,1)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned} \tag{E.2}$$

where

$b_{-1}^{(-1,1)}=-\frac{1}{4},$

$b_0^{(-1,1)}=\frac{\alpha_0^4}{8(x-1)}+\frac{\alpha_0^4}{8}-\frac{\alpha_0^3}{2\ (x-1)}+\frac{\alpha_0^3}{6(x-1)^2}-\frac{2\alpha_0^3}{3}+\frac{3\alpha_0^2}{4\ (x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{4(x-1)^3}+\frac{3\ \alpha_0^2}{2}-\frac{\alpha_0}{2(x-1)}+\frac{\alpha_0}{2(x-1)^2}-\frac{\alpha_0}{2\ (x-1)^3}+\frac{\alpha_0}{2(x-1)^4}-2\alpha_0+\Big(\frac{1}{2}+\frac{1}{2\ (x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{1}{2}-\frac{1}{2(x-1)^5}\Big)\ H(0;x)+\frac{H(c_1(\alpha_0);x)}{2(x-1)^5}-\frac{1}{4},$

$$b_1^{(-1,1)} = -\frac{d_1\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{16(x-1)} + \frac{\alpha_0^4}{4\ (x-1)} + \frac{\alpha_0^4}{4} + \frac{13d_1\alpha_0^3}{36} + \frac{\alpha_0^3}{6(x-2)} + \frac{d_1\alpha_0^3}{4(x-1)} - \frac{13\alpha_0^3}{12(x-1)} - \frac{d_1\ \alpha_0^3}{9(x-1)^2} +$$

$$\frac{17\alpha_0^3}{36(x-1)^2} - \frac{53\ \alpha_0^3}{36} - \frac{23d_1\alpha_0^2}{24} - \frac{5\alpha_0^2}{6(x-2)} - \frac{3\ d_1\alpha_0^2}{8(x-1)} + \frac{23\alpha_0^2}{12(x-1)} + \frac{2\alpha_0^2}{3\ (x-2)^2} + \frac{d_1\alpha_0^2}{3(x-1)^2} - \frac{19\alpha_0^2}{12\ (x-1)^2} - \frac{d_1\alpha_0^2}{4(x-1)^3} +$$

$$\frac{25\alpha_0^2}{24\ (x-1)^3} + \frac{95\alpha_0^2}{24} + \frac{25d_1\alpha_0}{12} + \frac{7\alpha_0}{3\ (x-2)} + \frac{d_1\alpha_0}{4(x-1)} - \frac{9\alpha_0}{4(x-1)} - \frac{10\alpha_0}{3\ (x-2)^2} - \frac{d_1\alpha_0}{3(x-1)^2} + \frac{13\alpha_0}{6(x-1)^2} + \frac{4\ \alpha_0}{(x-2)^3} + \frac{d_1\alpha_0}{2(x-1)^3} -$$

$$\frac{31\alpha_0}{12\ (x-1)^3} - \frac{d_1\alpha_0}{(x-1)^4} + \frac{43\alpha_0}{12(x-1)^4} - \frac{97\ \alpha_0}{12} + \bigg(- \frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} + \frac{2\ \alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} - \frac{3\ \alpha_0^2}{x-1} + \frac{2\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} -$$

$$6\ \alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\ \alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{4}{x-2} + \frac{5}{2\ (x-1)} + \frac{16}{3(x-2)^2} - \frac{1}{12\ (x-1)^2} - \frac{8}{(x-2)^3} - \frac{5}{12\ (x-1)^3} +$$

$$\frac{16}{(x-2)^4} + \frac{1}{(x-1)^4} + \frac{31}{12\ (x-1)^5} - \frac{19}{12}\bigg) H(0;\alpha_0) + \bigg(- \frac{5}{2\ (x-1)} + \frac{1}{12(x-1)^2} + \frac{5}{12\ (x-1)^3} - \frac{1}{(x-1)^4} - \frac{31}{12\ (x-1)^5} +$$

$$\frac{31}{12} + \frac{4}{x-2} - \frac{16}{3\ (x-2)^2} + \frac{8}{(x-2)^3} - \frac{16}{(x-2)^4}\bigg)\ H(0;x) + \bigg(- \frac{d_1\alpha_0^4}{4} - \frac{d_1\alpha_0^4}{4(x-1)} + \frac{4\ d_1\alpha_0^3}{3} + \frac{d_1\alpha_0^3}{x-1} - \frac{d_1\alpha_0^3}{3(x-1)^2} - 3d_1\ \alpha_0^2 -$$

$$\frac{3d_1\alpha_0^2}{2(x-1)} + \frac{d_1\alpha_0^2}{(x-1)^2} - \frac{d_1\ \alpha_0^2}{2(x-1)^3} + 4d_1\alpha_0 + \frac{d_1\alpha_0}{x-1} - \frac{d_1\ \alpha_0}{(x-1)^2} + \frac{d_1\alpha_0}{(x-1)^3} - \frac{d_1\ \alpha_0}{(x-1)^4} - \frac{25d_1}{12} - \frac{d_1}{4(x-1)} + \frac{d_1}{3\ (x-1)^2} -$$

$$\frac{d_1}{2(x-1)^3} + \frac{d_1}{(x-1)^4}\bigg)\ H(1;\alpha_0) + \bigg(\frac{d_1}{(x-1)^5} + \frac{16}{(x-2)^5} - \frac{1}{(x-1)^5}\ + 1\bigg) H(0;\alpha_0) H(1;x) + \bigg(- \frac{\alpha_0^4}{4(x-2)} - \frac{\alpha_0^4}{4\ (x-1)} -$$

$$\frac{\alpha_0^4}{4} + \frac{\alpha_0^3}{x-2} + \frac{\alpha_0^3}{x-1} - \frac{2\ \alpha_0^3}{3(x-2)^2} - \frac{\alpha_0^3}{3(x-1)^2} + \frac{4\alpha_0^3}{3} - \frac{3\ \alpha_0^2}{2(x-2)} - \frac{3\alpha_0^2}{2(x-1)} + \frac{2\ \alpha_0^2}{(x-2)^2} + \frac{\alpha_0^2}{(x-1)^2} - \frac{2\ \alpha_0^2}{(x-2)^3} - \frac{\alpha_0^2}{2(x-1)^3} - 3\ \alpha_0^2 +$$

$$\frac{\alpha_0}{x-2} + \frac{\alpha_0}{x-1} - \frac{2\ \alpha_0}{(x-2)^2} - \frac{\alpha_0}{(x-1)^2} + \frac{4\ \alpha_0}{(x-2)^3} + \frac{\alpha_0}{(x-1)^3} - \frac{8\ \alpha_0}{(x-2)^4} - \frac{\alpha_0}{(x-1)^4} + 4\alpha_0 - \frac{2\ H(0;\alpha_0)}{(x-1)^5} - \frac{d_1\ H(1;\alpha_0)}{(x-1)^5} - \frac{4}{x-2} +$$

$$\frac{5}{2(x-1)} + \frac{16}{3\ (x-2)^2} - \frac{1}{12(x-1)^2} - \frac{8}{(x-2)^3} - \frac{5}{12(x-1)^3} + \frac{16}{(x-2)^4} + \frac{1}{(x-1)^4} + \frac{31}{12\ (x-1)^5} - \frac{25}{12}\bigg)\ H(c_1(\alpha_0);x) +$$

$$\bigg(- 2 - \frac{2}{(x-1)^5}\bigg)\ H(0,0;\alpha_0) + \bigg(\frac{2}{(x-1)^5} - 2\bigg)\ H(0,0;x) + \bigg(- \frac{d_1}{(x-1)^5} - d_1\bigg)\ H(0,1;\alpha_0) + \bigg(- \frac{1}{(x-1)^5} +$$

$$1 + \frac{16}{(x-2)^5}\bigg) H(0,c_1(\ \alpha_0);x) + \bigg(- \frac{d_1}{(x-1)^5} - \frac{16}{(x-2)^5} + \frac{1}{(x-1)^5}\ - 1\bigg) H(1,0;x) + \bigg(\frac{d_1}{(x-1)^5} + \frac{16}{(x-2)^5} -$$

$$\frac{1}{(x-1)^5} + 1\bigg)\ H(1,c_1(\alpha_0);x) - \frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{16\ H(c_2(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5} - \frac{4\pi^2}{(x-2)^5} + \frac{\pi^{\ 2}}{6(x-1)^5} - \frac{\pi^2}{6} - \frac{1}{4},$$

$$b_2^{(-1,1)} = \frac{d_1^2\alpha_0^4}{32} - \frac{3d_1\alpha_0^4}{16} + \frac{d_1^2\alpha_0^4}{32\ (x-1)} - \frac{3d_1\alpha_0^4}{16(x-1)} - \frac{\pi^2\alpha_0^4}{48\ (x-1)} + \frac{3\alpha_0^4}{8(x-1)} - \frac{\pi^2\alpha_0^4}{48} + \frac{3\ \alpha_0^4}{8} - \frac{43d_1^2\alpha_0^3}{216} + \frac{271d_1\ \alpha_0^3}{216} -$$

$$\frac{7d_1\alpha_0^3}{36(x-2)} + \frac{5\alpha_0^3}{9\ (x-2)} - \frac{d_1^2\alpha_0^3}{8(x-1)} + \frac{61d_1\alpha_0^3}{72\ (x-1)} + \frac{\pi^2\alpha_0^3}{12(x-1)} - \frac{16\alpha_0^3}{9(x-1)} + \frac{2\ d_1^2\alpha_0^3}{27(x-1)^2} - \frac{109d_1\alpha_0^3}{216(x-1)^2} - \frac{\pi^{\ 2}\alpha_0^3}{36(x-1)^2} + \frac{26\alpha_0^3}{27(x-1)^2} +$$

$$\frac{\pi^2\ \alpha_0^3}{9} - \frac{133\alpha_0^3}{54} + \frac{95d_1^2\alpha_0^2}{144} - \frac{209\ d_1\alpha_0^2}{48} + \frac{41d_1\alpha_0^2}{36(x-2)} - \frac{28\alpha_0^2}{9\ (x-2)} + \frac{3d_1^2\alpha_0^2}{16(x-1)} - \frac{61d_1\alpha_0^2}{36\ (x-1)} - \frac{\pi^2\alpha_0^2}{8(x-1)} + \frac{253\alpha_0^2}{72\ (x-1)} - \frac{10d_1\alpha_0^2}{9(x-2)^2} +$$

$$\frac{26\alpha_0^2}{9\ (x-2)^2} - \frac{2d_1^2\alpha_0^2}{9(x-1)^2} + \frac{43d_1\alpha_0^2}{24\ (x-1)^2} + \frac{\pi^2\alpha_0^2}{12(x-1)^2} - \frac{281\alpha_0^2}{72\ (x-1)^2} + \frac{d_1^2\alpha_0^2}{4(x-1)^3} - \frac{247d_1\alpha_0^2}{144\ (x-1)^3} - \frac{\pi^2\alpha_0^2}{24(x-1)^3} + \frac{55\alpha_0^2}{18(x-1)^3} - \frac{\pi^2\alpha_0^2}{4} +$$

$$\frac{295\alpha_0^2}{36} - \frac{205d_1^2\alpha_0}{72} + \frac{425d_1\alpha_0}{24} - \frac{97d_1\alpha_0}{18(x-2)} + \frac{221\alpha_0}{18\ (x-2)} - \frac{d_1^2\alpha_0}{8(x-1)} + \frac{91d_1\alpha_0}{24\ (x-1)} + \frac{\pi^2\alpha_0}{12(x-1)} - \frac{17\alpha_0}{3(x-1)} + \frac{74\ d_1\alpha_0}{9(x-2)^2} - \frac{178\alpha_0}{9(x-2)^2} +$$

$$\frac{2d_1^2\alpha_0}{9\ (x-1)^2} - \frac{29d_1\alpha_0}{9(x-1)^2} - \frac{\pi^2\alpha_0}{12\ (x-1)^2} + \frac{145\alpha_0}{18(x-1)^2} - \frac{12d_1\ \alpha_0}{(x-2)^3} + \frac{28\alpha_0}{(x-2)^3} - \frac{d_1^2\alpha_0}{2\ (x-1)^3} + \frac{355d_1\alpha_0}{72(x-1)^3} + \frac{\pi^2\alpha_0}{12\ (x-1)^3} - \frac{409\alpha_0}{36(x-1)^3} +$$

$$\frac{2d_1^2\ \alpha_0}{(x-1)^4} - \frac{865d_1\alpha_0}{72(x-1)^4} - \frac{\pi^2\alpha_0}{12\ (x-1)^4} + \frac{661\alpha_0}{36(x-1)^4} + \frac{\pi^2\alpha_0}{3} - \frac{1039\ \alpha_0}{36} + \bigg(\frac{d_1\alpha_0^4}{4} + \frac{d_1\alpha_0^4}{4\ (x-1)} - \frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{13d_1\alpha_0^3}{9} - \frac{2\ \alpha_0^3}{3(x-2)} -$$

$$\frac{d_1\alpha_0^3}{x-1} + \frac{13\alpha_0^3}{3\ (x-1)} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{17\alpha_0^3}{9\ (x-1)^2} + \frac{53\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{6} + \frac{10\alpha_0^2}{3\ (x-2)} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{23\alpha_0^2}{3(x-1)} - \frac{8\ \alpha_0^2}{3(x-2)^2} - \frac{4d_1\alpha_0^2}{3(x-1)^2} +$$

$$\frac{19\alpha_0^2}{3\ (x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{25\alpha_0^2}{6\ (x-1)^3} - \frac{95\alpha_0^2}{6} - \frac{25d_1\alpha_0}{3} - \frac{28\alpha_0}{3\ (x-2)} - \frac{d_1\alpha_0}{x-1} + \frac{9\alpha_0}{x-1} + \frac{40\alpha_0}{3\ (x-2)^2} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{26\alpha_0}{3\ (x-1)^2} -$$

$$\frac{16\alpha_0}{(x-2)^3} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{31\ \alpha_0}{3(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{43\alpha_0}{3\ (x-1)^4} + \frac{97\alpha_0}{3} + \frac{205d_1}{72} + \frac{34d_1}{3\ (x-2)} - \frac{8}{x-2} - \frac{109d_1}{12(x-1)} - \frac{1}{3\ (x-1)} -$$

$$\frac{116d_1}{9(x-2)^2} + \frac{112}{9(x-2)^2} + \frac{37\ d_1}{72(x-1)^2} + \frac{2}{9(x-1)^2} + \frac{16\ d_1}{(x-2)^3} - \frac{24}{(x-2)^3} + \frac{29d_1}{72\ (x-1)^3} - \frac{31}{18(x-1)^3} - \frac{32\ d_1}{(x-2)^4} + \frac{80}{(x-2)^4} -$$

$$\frac{2\ d_1}{(x-1)^4} + \frac{4}{(x-1)^4} - \frac{205d_1}{72(x-1)^5} - \frac{\pi^{\ 2}}{12(x-1)^5} + \frac{403}{36(x-1)^5} - \frac{\pi^{\ 2}}{12} - \frac{367}{36}\bigg) H(0;\alpha_0) + \bigg(- \frac{34d_1}{3\ (x-2)} + \frac{109d_1}{12(x-1)} + \frac{116d_1}{9(x-2)^2} -$$

$$\frac{37\ d_1}{72(x-1)^2} - \frac{16d_1}{(x-2)^3} - \frac{29d_1}{72\ (x-1)^3} + \frac{32d_1}{(x-2)^4} + \frac{2d_1}{(x-1)^4} + \frac{205\ d_1}{72(x-1)^5} - \frac{205d_1}{72} + \frac{8}{x-2} + \frac{1}{3\ (x-1)} - \frac{112}{9(x-2)^2} - \frac{2}{9\ (x-1)^2} +$$

$$\frac{24}{(x-2)^3} + \frac{31}{18(x-1)^3} - \frac{80}{(x-2)^4} - \frac{4}{(x-1)^4} + \frac{16\pi^2}{(x-2)^5} - \frac{7\pi^2}{12\ (x-1)^5} - \frac{403}{36(x-1)^5} + \frac{3\pi^{\ 2}}{4} + \frac{403}{36}\bigg) H(0;x) + \bigg(\frac{d_1^2\ \alpha_0^4}{8} -$$

$$\frac{d_1\alpha_0^4}{2} + \frac{d_1^2\alpha_0^4}{8(x-1)} - \frac{d_1\ \alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{18} + \frac{53d_1\ \alpha_0^3}{18} - \frac{d_1\alpha_0^3}{3(x-2)} - \frac{d_1^2\alpha_0^3}{2\ (x-1)} + \frac{13d_1\alpha_0^3}{6(x-1)} + \frac{2d_1^2\alpha_0^3}{9\ (x-1)^2} - \frac{17d_1\alpha_0^3}{18(x-1)^2} + \frac{23d_1^2\ \alpha_0^2}{12} -$$

$$\frac{95d_1\alpha_0^2}{12} + \frac{5d_1\alpha_0^2}{3\ (x-2)} + \frac{3d_1^2\alpha_0^2}{4(x-1)} - \frac{23d_1\alpha_0^2}{6\ (x-1)} - \frac{4d_1\alpha_0^2}{3(x-2)^2} - \frac{2d_1^2\alpha_0^2}{3(x-1)^2} + \frac{19d_1\alpha_0^2}{6(x-1)^2} + \frac{d_1^2\alpha_0^2}{2(x-1)^3} - \frac{25\ d_1\alpha_0^2}{12(x-1)^3} - \frac{25d_1^2\alpha_0}{6} + \frac{97d_1\ \alpha_0}{6} -$$

$$\frac{14d_1\alpha_0}{3(x-2)} - \frac{d_1^2\alpha_0}{2(x-1)} + \frac{9\ d_1\alpha_0}{2(x-1)} + \frac{20d_1\alpha_0}{3(x-2)^2} + \frac{2d_1^2\alpha_0}{3\ (x-1)^2} - \frac{13d_1\alpha_0}{3(x-1)^2} - \frac{8d_1\ \alpha_0}{(x-2)^3} - \frac{d_1^2\alpha_0}{(x-1)^3} + \frac{31d_1\alpha_0}{6(x-1)^3} + \frac{2d_1^2\alpha_0}{(x-1)^4} - \frac{43d_1\alpha_0}{6(x-1)^4} +$$

$$\frac{205\ d_1^2}{72}-\frac{385d_1}{36}+\frac{10d_1}{3(x-2)}+\frac{d_1^2}{8\ (x-1)}-\frac{7d_1}{3(x-1)}-\frac{16d_1}{3(x-2)^2}-\frac{2\ d_1^2}{9(x-1)^2}+\frac{19d_1}{9(x-1)^2}+\frac{8\ d_1}{(x-2)^3}+\frac{d_1^2}{2(x-1)^3}-\frac{37d_1}{12\ (x-1)^3}-$$

$$\frac{2d_1^2}{(x-1)^4}+\frac{43d_1}{6(x-1)^4}\Big)\ H(1;\alpha_0)+\Big(\frac{8\pi^2d_1}{(x-2)^5}-\frac{16\pi^2}{(x-2)^5}+\frac{\pi^2}{4(x-1)^5}-\frac{\pi^2}{4}\Big)H(2;x)+\Big(\frac{2\ \alpha_0^4}{x-1}+2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3\ (x-1)^2}-$$

$$\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\ \alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2-\frac{8\ \alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\ \alpha_0}{(x-1)^4}-32\alpha_0+\frac{16}{x-2}-\frac{10}{x-1}-\frac{64}{3\ (x-2)^2}+$$

$$\frac{1}{3(x-1)^2}+\frac{32}{(x-2)^3}+\frac{5}{3\ (x-1)^3}-\frac{64}{(x-2)^4}-\frac{4}{(x-1)^4}-\frac{31}{3\ (x-1)^5}+\frac{19}{3}\Big)H(0,0;\alpha_0)+\Big(\frac{10}{x-1}-\frac{1}{3\ (x-1)^2}-\frac{5}{3(x-1)^3}+$$

$$\frac{4}{(x-1)^4}+\frac{31}{3\ (x-1)^5}-\frac{31}{3}-\frac{16}{x-2}+\frac{64}{3\ (x-2)^2}-\frac{32}{(x-2)^3}+\frac{64}{(x-2)^4}\Big)H(0,0;x)+\Big(d_1\ \alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\ \alpha_0^3}{x-1}+$$

$$\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+\frac{6d_1\ \alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\ \alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\ \alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}+\frac{19d_1}{6}+\frac{8d_1}{x-2}-$$

$$\frac{5\ d_1}{x-1}-\frac{32d_1}{3(x-2)^2}+\frac{d_1}{6(x-1)^2}+\frac{16\ d_1}{(x-2)^3}+\frac{5d_1}{6(x-1)^3}-\frac{32d_1}{(x-2)^4}-\frac{2\ d_1}{(x-1)^4}-\frac{31d_1}{6(x-1)^5}\Big)H(0,1;\alpha_0)+H(1;x)\ \Big(\frac{\pi^2d_1}{3(x-1)^5}+$$

$$\Big(-\frac{15d_1}{2\ (x-2)}+\frac{11d_1}{2(x-1)}+\frac{28d_1}{3(x-2)^2}-\frac{5d_1}{6\ (x-1)^2}-\frac{12d_1}{(x-2)^3}+\frac{d_1}{6(x-1)^3}+\frac{16\ d_1}{(x-2)^4}+\frac{31d_1}{6(x-1)^5}-\frac{3}{2\ (x-2)}+\frac{5}{x-1}+\frac{8}{3(x-2)^2}-$$

$$\frac{29}{12\ (x-1)^2}-\frac{8}{3(x-2)^3}+\frac{5}{4(x-1)^3}-\frac{7}{2(x-1)^4}+\frac{16}{(x-2)^5}-\frac{31}{6(x-1)^5}+\frac{31}{6}\Big)\ H(0;\alpha_0)+\Big(-\frac{4\ d_1}{(x-1)^5}-\frac{64}{(x-2)^5}+$$

$$\frac{4}{(x-1)^5}-4\Big)H(0,0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}-\frac{32d_1}{(x-2)^5}+\frac{2\ d_1}{(x-1)^5}-2d_1\Big)H(0,1;\alpha_0)-\frac{8\pi^2}{3(x-2)^5}-\frac{\pi^2}{3(x-1)^5}+\frac{\pi^2}{6}\Big)+$$

$$\Big(\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+2\ d_1-\frac{32}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)\ H(0,1;x)+\Big(-\frac{\alpha_0^4}{2(x-2)}+\frac{2\alpha_0^3}{x-2}-\frac{4\ \alpha_0^3}{3(x-2)^2}-\frac{3\alpha_0^2}{x-2}+$$

$$\frac{4\alpha_0^2}{(x-2)^2}-\frac{4\ \alpha_0^2}{(x-2)^3}+\frac{2\alpha_0}{x-2}-\frac{4\alpha_0}{(x-2)^2}+\frac{8\ \alpha_0}{(x-2)^3}-\frac{16\ \alpha_0}{(x-2)^4}+\Big(\frac{4}{(x-1)^5}-4-\frac{64}{(x-2)^5}\Big)\ H(0;\alpha_0)+\Big(-\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-$$

$$2\ d_1\Big)H(1;\alpha_0)-\frac{2}{x-2}+\frac{5}{x-1}+\frac{4}{(x-2)^2}-\frac{29}{12(x-1)^2}-\frac{20}{3(x-2)^3}+\frac{5}{4\ (x-1)^3}+\frac{16}{(x-2)^4}-\frac{7}{2\ (x-1)^4}+\frac{16}{(x-2)^5}-$$

$$\frac{31}{6(x-1)^5}+\frac{31}{6}\Big)\ H(0,c_1(\alpha_0);x)+\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\ \alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12\ d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+$$

$$\frac{2\ d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\ \alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{3}+\frac{d_1}{x-1}-\frac{4d_1}{3\ (x-1)^2}+\frac{2d_1}{(x-1)^3}-\frac{4d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+$$

$$\Big(\frac{15d_1}{2(x-2)}-\frac{11d_1}{2(x-1)}-\frac{28d_1}{3\ (x-2)^2}+\frac{5d_1}{6(x-1)^2}+\frac{12d_1}{(x-2)^3}-\frac{d_1}{6\ (x-1)^3}-\frac{16d_1}{(x-2)^4}-\frac{31d_1}{6(x-1)^5}+\frac{3}{2\ (x-2)}-\frac{5}{x-1}-\frac{8}{3(x-2)^2}+$$

$$\frac{29}{12\ (x-1)^2}+\frac{8}{3(x-2)^3}-\frac{5}{4(x-1)^3}+\frac{7}{2(x-1)^4}-\frac{16}{(x-2)^5}+\frac{31}{6(x-1)^5}-\frac{31}{6}\Big)\ H(1,0;x)+\Big(\frac{d_1^2\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{2\ (x-1)}-\frac{8d_1^2\alpha_0^3}{3}-$$

$$\frac{2d_1^2\alpha_0^3}{x-1}+\frac{2\ d_1^2\alpha_0^3}{3(x-1)^2}+6d_1^2\alpha_0^2+\frac{3d_1^2\ \alpha_0^2}{x-1}-\frac{2d_1^2\alpha_0^2}{(x-1)^2}+\frac{d_1^2\ \alpha_0^2}{(x-1)^3}-8d_1^2\alpha_0-\frac{2d_1^2\alpha_0}{x-1}+\frac{2d_1^2\ \alpha_0}{(x-1)^2}-\frac{2d_1^2\alpha_0}{(x-1)^3}+\frac{2d_1^2\ \alpha_0}{(x-1)^4}+\frac{25d_1^2}{6}+$$

$$\frac{d_1^2}{2(x-1)}-\frac{2\ d_1^2}{3(x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{2d_1^2}{(x-1)^4}\Big)\ H(1,1;\alpha_0)+H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{8}+\frac{d_1\alpha_0^4}{8\ (x-2)}-\frac{\alpha_0^4}{2(x-2)}+\frac{d_1\alpha_0^4}{8(x-1)}-$$

$$\frac{\alpha_0^4}{2\ (x-1)}-\frac{\alpha_0^4}{2}-\frac{13d_1\alpha_0^3}{18}-\frac{d_1\alpha_0^3}{2\ (x-2)}+\frac{5\alpha_0^3}{3(x-2)}-\frac{d_1\alpha_0^3}{2(x-1)}+\frac{29\ \alpha_0^3}{12(x-1)}+\frac{4d_1\alpha_0^3}{9(x-2)^2}-\frac{14\alpha_0^3}{9\ (x-2)^2}+\frac{2d_1\alpha_0^3}{9(x-1)^2}-\frac{17\alpha_0^3}{18\ (x-1)^2}+$$

$$\frac{53\alpha_0^3}{18}+\frac{23d_1\alpha_0^2}{12}+\frac{3d_1\ \alpha_0^2}{4(x-2)}-\frac{5\alpha_0^2}{4(x-2)}+\frac{3d_1\alpha_0^2}{4\ (x-1)}-\frac{61\alpha_0^2}{12(x-1)}-\frac{4d_1\alpha_0^2}{3\ (x-2)^2}+\frac{10\alpha_0^2}{3(x-2)^2}-\frac{2d_1\alpha_0^2}{3\ (x-1)^2}+\frac{43\alpha_0^2}{12(x-1)^2}+\frac{2d_1\ \alpha_0^2}{(x-2)^3}-$$

$$\frac{6\alpha_0^2}{(x-2)^3}+\frac{d_1\alpha_0^2}{2\ (x-1)^3}-\frac{25\alpha_0^2}{12(x-1)^3}-\frac{95\alpha_0^2}{12}-\frac{25d_1\ \alpha_0}{6}-\frac{d_1\alpha_0}{2(x-2)}-\frac{25\alpha_0}{6(x-2)}-\frac{d_1\ \alpha_0}{2(x-1)}+\frac{103\alpha_0}{12(x-1)}+\frac{4d_1\alpha_0}{3\ (x-2)^2}+\frac{10\alpha_0}{3(x-2)^2}+$$

$$\frac{2d_1\alpha_0}{3\ (x-1)^2}-\frac{73\alpha_0}{12(x-1)^2}-\frac{4d_1\alpha_0}{(x-2)^3}+\frac{4\ \alpha_0}{(x-2)^3}-\frac{d_1\alpha_0}{(x-1)^3}+\frac{37\alpha_0}{6\ (x-1)^3}+\frac{16d_1\alpha_0}{(x-2)^4}-\frac{40\alpha_0}{(x-2)^4}+\frac{2\ d_1\alpha_0}{(x-1)^4}-\frac{43\alpha_0}{6(x-1)^4}+\frac{97\alpha_0}{6}+$$

$$\frac{205\ d_1}{72}+\Big(\frac{\alpha_0^4}{x-2}+\frac{\alpha_0^4}{x-1}+\alpha_0^4-\frac{4\ \alpha_0^3}{x-2}-\frac{4\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-2)^2}+\frac{4\ \alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}+\frac{6\alpha_0^2}{x-2}+\frac{6\ \alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-2)^2}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{8\ \alpha_0^2}{(x-2)^3}+$$

$$\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2-\frac{4\ \alpha_0}{x-2}-\frac{4\alpha_0}{x-1}+\frac{8\alpha_0}{(x-2)^2}+\frac{4\ \alpha_0}{(x-1)^2}-\frac{16\alpha_0}{(x-2)^3}-\frac{4\alpha_0}{(x-1)^3}+\frac{32\ \alpha_0}{(x-2)^4}+\frac{4\alpha_0}{(x-1)^4}-16\ \alpha_0+\frac{16}{x-2}-\frac{10}{x-1}-$$

$$\frac{64}{3(x-2)^2}+\frac{1}{3\ (x-1)^2}+\frac{32}{(x-2)^3}+\frac{5}{3\ (x-1)^3}-\frac{64}{(x-2)^4}-\frac{4}{(x-1)^4}-\frac{31}{3\ (x-1)^5}+\frac{25}{3}\Big)H(0;\alpha_0)+\Big(\frac{d_1\ \alpha_0^4}{2}+\frac{d_1\alpha_0^4}{2(x-2)}+$$

$$\frac{d_1\alpha_0^4}{2(x-1)}-\frac{8\ d_1\alpha_0^3}{3}-\frac{2d_1\alpha_0^3}{x-2}-\frac{2d_1\alpha_0^3}{x-1}+\frac{4\ d_1\alpha_0^3}{3(x-2)^2}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+6d_1\ \alpha_0^2+\frac{3d_1\alpha_0^2}{x-2}+\frac{3d_1\alpha_0^2}{x-1}-\frac{4d_1\ \alpha_0^2}{(x-2)^2}-\frac{2d_1\alpha_0^2}{(x-1)^2}+\frac{4d_1\ \alpha_0^2}{(x-2)^3}+$$

$$\frac{d_1\alpha_0^2}{(x-1)^3}-8d_1\alpha_0-\frac{2d_1\ \alpha_0}{x-2}-\frac{2d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-2)^2}+\frac{2d_1\ \alpha_0}{(x-1)^2}-\frac{8d_1\alpha_0}{(x-2)^3}-\frac{2d_1\ \alpha_0}{(x-1)^3}+\frac{16d_1\alpha_0}{(x-2)^4}+\frac{2d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{6}+\frac{8d_1}{x-2}-\frac{5\ d_1}{x-1}-$$

$$\frac{32d_1}{3(x-2)^2}+\frac{d_1}{6(x-1)^2}+\frac{16\ d_1}{(x-2)^3}+\frac{5d_1}{6(x-1)^3}-\frac{32d_1}{(x-2)^4}-\frac{2\ d_1}{(x-1)^4}-\frac{31d_1}{6(x-1)^5}\Big)H(1;\alpha_0)+\frac{8\ H(0,0;\alpha_0)}{(x-1)^5}+\frac{4d_1H(0,1;\alpha_0)}{(x-1)^5}+$$

$$\frac{4d_1\ H(1,0;\alpha_0)}{(x-1)^5}+\frac{2d_1^2H(1,1;\alpha_0)}{(x-1)^5}+\frac{34\ d_1}{3(x-2)}-\frac{8}{x-2}-\frac{109d_1}{12(x-1)}-\frac{1}{3\ (x-1)}-\frac{116d_1}{9(x-2)^2}+\frac{112}{9(x-2)^2}+\frac{37\ d_1}{72(x-1)^2}+\frac{2}{9(x-1)^2}+$$

$$\frac{16\ d_1}{(x-2)^3}-\frac{24}{(x-2)^3}+\frac{29d_1}{72\ (x-1)^3}-\frac{31}{18(x-1)^3}-\frac{32\ d_1}{(x-2)^4}+\frac{80}{(x-2)^4}-\frac{2\ d_1}{(x-1)^4}+\frac{4}{(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^{\ 2}}{12(x-1)^5}+$$

$$\frac{403}{36\ (x-1)^5}-\frac{385}{36}\Big)+\Big(\frac{2d_1^2}{(x-1)^5}+\frac{32\ d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2\ d_1+\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)H(0;\alpha_0)\ H(1,1;x)+\Big(-$$
$$\frac{15d_1}{2(x-2)}+\frac{11d_1}{2(x-1)}+\frac{28\ d_1}{3(x-2)^2}-\frac{5d_1}{6(x-1)^2}-\frac{12\ d_1}{(x-2)^3}+\frac{d_1}{6(x-1)^3}+\frac{16d_1}{(x-2)^4}+\frac{31\ d_1}{6(x-1)^5}+\Big(-\frac{4\ d_1}{(x-1)^5}-\frac{64}{(x-2)^5}+\frac{4}{(x-1)^5}-$$
$$4\Big)\ H(0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}-\frac{32d_1}{(x-2)^5}+\frac{2\ d_1}{(x-1)^5}-2d_1\Big)H(1;\alpha_0)-\frac{3}{2\ (x-2)}+\frac{5}{x-1}+\frac{8}{3(x-2)^2}-\frac{29}{12\ (x-1)^2}-$$
$$\frac{8}{3(x-2)^3}+\frac{5}{4(x-1)^3}-\frac{7}{2(x-1)^4}+\frac{16}{(x-2)^5}-\frac{31}{6(x-1)^5}+\frac{31}{6}\Big)\ H(1,c_1(\alpha_0);x)+\Big(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+$$
$$1\Big)H(0;\alpha_0)\ H(2,1;x)+\Big(\frac{5\alpha_0^4}{4(x-2)}+\frac{\alpha_0^4}{2(x-1)}+\frac{3\ \alpha_0^4}{4}-\frac{5\alpha_0^3}{x-2}-\frac{2\alpha_0^3}{x-1}+\frac{10\alpha_0^3}{3\ (x-2)^2}+\frac{2\alpha_0^3}{3(x-1)^2}-4\alpha_0^3+\frac{15\alpha_0^2}{2\ (x-2)}+$$
$$\frac{3\alpha_0^2}{x-1}-\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\ \alpha_0^2}{(x-1)^2}+\frac{10\alpha_0^2}{(x-2)^3}+\frac{\alpha_0^2}{(x-1)^3}+9\ \alpha_0^2-\frac{5\alpha_0}{x-2}-\frac{2\alpha_0}{x-1}+\frac{10\ \alpha_0}{(x-2)^2}+\frac{2\alpha_0}{(x-1)^2}-\frac{20\alpha_0}{(x-2)^3}-\frac{2\ \alpha_0}{(x-1)^3}+\frac{40\alpha_0}{(x-2)^4}+$$
$$\frac{2\alpha_0}{(x-1)^4}-12\ \alpha_0+\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1\ H(1;\alpha_0)}{(x-1)^5}+\frac{20}{x-2}-\frac{61}{4(x-1)}-\frac{80}{3\ (x-2)^2}+\frac{29}{12(x-1)^2}+\frac{40}{(x-2)^3}-\frac{1}{12\ (x-1)^3}-\frac{80}{(x-2)^4}-$$
$$\frac{3}{2(x-1)^4}-\frac{31}{6(x-1)^5}+\frac{25}{4}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\ (x-1)^2}+\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2\ (x-1)}-\frac{\alpha_0^2}{(x-1)^2}+$$
$$\frac{\alpha_0^2}{2(x-1)^3}-3\ \alpha_0^2-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}+4\alpha_0+\frac{64H(0;\alpha_0)}{(x-2)^5}+\frac{32d_1\ H(1;\alpha_0)}{(x-2)^5}-\frac{2}{x-2}+\frac{1}{4(x-1)}+\frac{4}{3\ (x-2)^2}+$$
$$\frac{1}{3(x-1)^2}-\frac{4}{3(x-2)^3}+\frac{1}{2(x-1)^3}+\frac{1}{(x-1)^4}-\frac{16}{(x-2)^5}-\frac{25}{12}\Big)\ H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(8+\frac{8}{(x-1)^5}\Big)\ H(0,0,0;\alpha_0)+$$
$$\Big(8-\frac{8}{(x-1)^5}\Big)H(0,0,0;x)+\Big(\frac{4\ d_1}{(x-1)^5}+4d_1\Big)\ H(0,0,1;\alpha_0)+\Big(\frac{4}{(x-1)^5}-4-\frac{32}{(x-2)^5}\Big)\ H(0,0,c_1(\alpha_0);x)+$$
$$\Big(\frac{4d_1}{(x-1)^5}+4d_1\Big)H(0,1,0;\alpha_0)+\ \Big(-\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-2\ d_1+\frac{32}{(x-2)^5}-\frac{4}{(x-1)^5}+4\Big)\ H(0,1,0;x)+$$
$$\Big(\frac{2d_1^2}{(x-1)^5}+2d_1^2\Big)\ H(0,1,1;\alpha_0)+\Big(\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+2d_1-\ \frac{32}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)\ H(0,1,c_1(\alpha_0);x)+$$
$$\Big(\frac{2}{(x-1)^5}-3-\frac{80}{(x-2)^5}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{1}{(x-1)^5}+1+\frac{64}{(x-2)^5}\ \Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(\frac{4\ d_1}{(x-1)^5}+\frac{64}{(x-2)^5}-\frac{4}{(x-1)^5}+4\Big)H(1,0,0;x)+\ \Big(-\frac{2\ d_1}{(x-1)^5}+\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)\ H(1,0,c_1(\alpha_0);x)+\Big(-$$
$$\frac{2d_1^2}{(x-1)^5}-\frac{32\ d_1}{(x-2)^5}+\frac{4d_1}{(x-1)^5}-2\ d_1-\frac{16}{(x-2)^5}-\frac{2}{(x-1)^5}+1\Big)\ H(1,1,0;x)+\Big(\frac{2d_1^2}{(x-1)^5}+\frac{32\ d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2\ d_1+$$
$$\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Big)\ H(1,1,c_1(\alpha_0);x)+\Big(-\frac{2\ d_1}{(x-1)^5}-\frac{80}{(x-2)^5}+\frac{2}{(x-1)^5}-3\Big)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Big)\ H(2,0,c_1(\alpha_0);x)+\Big(\frac{32\ d_1}{(x-2)^5}-\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Big)H(2,1,0;x)+$$
$$\Big(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Big)\ H(2,1,c_1(\alpha_0);x)+\Big(\frac{32\ d_1}{(x-2)^5}-\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-$$
$$1\Big)\ H(2,c_2(\alpha_0),c_1(\alpha_0);x)+\frac{2\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{32\ H(c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-2)^5}+$$
$$\frac{80\ H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5}+\frac{\pi^2}{6\ (x-2)}-\frac{13\pi^2}{16(x-1)}-\frac{5\pi^2}{9(x-2)^2}+\frac{31\ \pi^2}{72(x-1)^2}+\frac{\pi^2}{(x-2)^3}-\frac{\pi^2}{6\ (x-1)^3}-\frac{8\pi^2}{3(x-2)^4}+$$
$$\frac{2\pi^2}{3\ (x-1)^4}-\frac{4\pi^2}{(x-2)^5}+\frac{31\pi^2}{36\ (x-1)^5}+\frac{28\zeta_3}{(x-2)^5}-\frac{21\zeta_3}{8\ (x-1)^5}+\frac{17\zeta_3}{8}-\frac{24\pi^2\ln 2}{(x-2)^5}+\frac{\pi^2\ln 2}{4(x-1)^5}-\frac{1}{4}\pi^2\ln 2\ \ -\frac{149\pi^2}{144}-\frac{1}{4}$$

E.3 The $\mathcal{B}$ integral for $k=2$ and $\delta=-1$ and $d_1=-3$

The ε expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,2,-1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,2)\\ &= \frac{1}{\varepsilon}b_{-1}^{(-1,2)}+b_0^{(-1,2)}+\varepsilon b_1^{(-1,2)}+\varepsilon^2 b_2^{(-1,2)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned} \tag{E.3}$$

where

$$b_{-1}^{(-1,2)}=-\tfrac{1}{6},$$

$$b_0^{(-1,2)}=-\frac{\alpha_0^{10}}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^9}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^8}{12(\alpha_0+1)^4(x-1)}+\frac{4\ \alpha_0^8}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}-$$
$$\frac{4\alpha_0^7}{3(\alpha_0+1)^4(x\ \alpha_0-2\alpha_0-x)}-\frac{\alpha_0^6}{3(\alpha_0+1)^4(x-1)}-\frac{2\ \alpha_0^6}{(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{\alpha_0^6}{9(\alpha_0+1)^3\ (x-1)^2}+\frac{\alpha_0^5}{3(x-2)}+$$

$$\frac{2\alpha_0^5}{(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}-\frac{5\alpha_0^4}{4(x-2)}+\frac{5\alpha_0^4}{12(\alpha_0+1)^4(x-1)}+\frac{4\alpha_0^4}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{5\alpha_0^4}{6(x-2)^2}-\frac{\alpha_0^4}{3(\alpha_0+1)^3(x-1)^2}+$$
$$\frac{\alpha_0^4}{6(\alpha_0+1)^2(x-1)^3}+\frac{\alpha_0^4}{12}+\frac{5\alpha_0^3}{3(x-2)}-\frac{\alpha_0^3}{3(\alpha_0+1)^4(x-1)}-\frac{4\alpha_0^3}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}-\frac{20\alpha_0^3}{9(x-2)^2}+\frac{\alpha_0^3}{9(\alpha_0+1)^3(x-1)^2}+$$
$$\frac{20\alpha_0^3}{9(x-2)^3}-\frac{4\alpha_0^3}{9}-\frac{5\alpha_0^2}{6(x-2)}-\frac{5\alpha_0^2}{6(\alpha_0+1)^4(x-1)}-\frac{\alpha_0^2}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+\frac{5\alpha_0^2}{3(x-2)^2}+\frac{2\alpha_0^2}{3(\alpha_0+1)^3(x-1)^2}-$$
$$\frac{10\alpha_0^2}{3(x-2)^3}-\frac{\alpha_0^2}{2(\alpha_0+1)^2(x-1)^3}+\frac{20\alpha_0^2}{3(x-2)^4}+\frac{\alpha_0^2}{3(\alpha_0+1)(x-1)^4}+\alpha_0^2-\frac{\alpha_0}{3(\alpha_0+1)^4(x-1)}+\frac{\alpha_0}{3(\alpha_0+1)^4(x\alpha_0-2\alpha_0-x)}+$$
$$\frac{\alpha_0}{3(\alpha_0+1)^3(x-1)^2}-\frac{\alpha_0}{3(\alpha_0+1)^2(x-1)^3}+\frac{\alpha_0}{3(\alpha_0+1)(x-1)^4}+\frac{80\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3}+\Bigg(\frac{1}{3(x-1)^5}+\frac{1}{3}+\frac{80}{3(x-2)^5}+$$
$$\frac{160}{3(x-2)^6}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{1}{3(x-1)^5}+\frac{1}{3}-\frac{80}{3(x-2)^5}-\frac{160}{3(x-2)^6}\Bigg)H(0;x)+\frac{H(c_1(\alpha_0);x)}{3(x-1)^5}+\Bigg(\frac{80}{3(x-2)^5}+$$
$$\frac{160}{3(x-2)^6}\Bigg)H(c_2(\alpha_0);x)+\frac{80\ln 2}{3(x-2)^5}+\frac{160\ln 2}{3(x-2)^6}-\frac{1}{9},$$

$$b_1^{(-1,2)}=\frac{1}{\alpha_0x-x-2\alpha_0}\Bigg\{\frac{19x\alpha_0^5}{72}+\frac{31\alpha_0^5}{36(x-2)}-\frac{19\alpha_0^5}{72(x-1)}+\frac{\alpha_0^5}{6}-\frac{131x\alpha_0^4}{72}-\frac{5\alpha_0^4}{2(x-2)}+\frac{95\alpha_0^4}{72(x-1)}+\frac{65\alpha_0^4}{18(x-2)^2}-$$
$$\frac{\alpha_0^4}{2(x-1)^2}-\frac{\alpha_0^4}{3}+\frac{52x\alpha_0^3}{9}+\frac{25\alpha_0^3}{18(x-2)}-\frac{95\alpha_0^3}{36(x-1)}-\frac{40\alpha_0^3}{9(x-2)^2}+\frac{53\alpha_0^3}{24(x-1)^2}+\frac{20\alpha_0^3}{(x-2)^3}-\frac{41\alpha_0^3}{36(x-1)^3}-\frac{121\alpha_0^3}{72}-\frac{40x\alpha_0^2}{3}+$$
$$\frac{23\alpha_0^2}{9(x-2)}+\frac{13\alpha_0^2}{6(x-1)}-\frac{9\alpha_0^2}{(x-2)^2}-\frac{271\alpha_0^2}{72(x-1)^2}+\frac{400\alpha_0^2}{9(x-2)^3}+\frac{17\alpha_0^2}{3(x-1)^3}+\frac{1880\alpha_0^2}{9(x-2)^4}-\frac{77\alpha_0^2}{18(x-1)^4}+\frac{857\alpha_0^2}{72}-\frac{1}{9}\pi^2x\alpha_0+\frac{244x\alpha_0}{27}-$$
$$\frac{10\alpha_0}{9(x-2)}-\frac{13\alpha_0}{12(x-1)}+\frac{6\alpha_0}{(x-2)^2}+\frac{31\alpha_0}{36(x-1)^2}-\frac{392\alpha_0}{9(x-2)^3}-\frac{7\alpha_0}{4(x-1)^3}+\frac{4\pi^2\alpha_0}{9(x-2)^4}-\frac{3760\alpha_0}{9(x-2)^4}+\frac{\pi^2\alpha_0}{9(x-1)^4}-\frac{77\alpha_0}{18(x-1)^4}+$$
$$\frac{80\pi^2\alpha_0}{9(x-2)^5}-\frac{5120\alpha_0}{9(x-2)^5}-\frac{\pi^2\alpha_0}{9(x-1)^5}+\frac{160\ln^2 2\,\alpha_0}{3(x-2)^4}+\frac{320\ln^2 2\,\alpha_0}{3(x-2)^5}+\frac{160\ln 2\,\alpha_0}{9(x-2)^4}+\frac{320\ln 2\,\alpha_0}{9(x-2)^5}+\frac{2\pi^2\alpha_0}{9}+\frac{265\alpha_0}{108}+\frac{\pi^2x}{9}+\frac{2x}{27}+$$
$$\Bigg(-\frac{x\alpha_0^5}{3}-\frac{2\alpha_0^5}{3(x-2)}+\frac{\alpha_0^5}{3(x-1)}+\frac{19x\alpha_0^4}{9}+\frac{20\alpha_0^4}{9(x-2)}-\frac{13\alpha_0^4}{9(x-1)}-\frac{20\alpha_0^4}{9(x-2)^2}+\frac{4\alpha_0^4}{9(x-1)^2}-\frac{2\alpha_0^4}{9}-\frac{52x\alpha_0^3}{9}-\frac{20\alpha_0^3}{9(x-2)}+\frac{22\alpha_0^3}{9(x-1)}+$$
$$\frac{40\alpha_0^3}{9(x-2)^2}-\frac{14\alpha_0^3}{9(x-1)^2}-\frac{80\alpha_0^3}{9(x-2)^3}+\frac{2\alpha_0^3}{3(x-1)^3}+\frac{4\alpha_0^3}{3}+\frac{28x\alpha_0^2}{3}-\frac{2\alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}-\frac{160\alpha_0^2}{3(x-2)^4}+\frac{4\alpha_0^2}{3(x-1)^4}-$$
$$4\alpha_0^2-\frac{13x\alpha_0}{2}-\frac{32\alpha_0}{9(x-2)}+\frac{37\alpha_0}{6(x-1)}+\frac{8\alpha_0}{9(x-2)^2}-\frac{13\alpha_0}{9(x-1)^2}+\frac{16\alpha_0}{(x-2)^3}+\frac{23\alpha_0}{18(x-1)^3}+\frac{2080\alpha_0}{9(x-2)^4}+\frac{79\alpha_0}{36(x-1)^4}+\frac{2240\alpha_0}{9(x-2)^5}-$$
$$\frac{29\alpha_0}{18(x-1)^5}-\frac{19\alpha_0}{12}+\frac{7x}{6}-\frac{40}{9(x-2)}+\frac{13}{3(x-1)}+\frac{56}{9(x-2)^2}-\frac{7}{18(x-1)^2}-\frac{160}{9(x-2)^3}-\frac{2}{9(x-1)^3}-\frac{1408}{9(x-2)^4}-\frac{85}{36(x-1)^4}-$$
$$\frac{2560}{9(x-2)^5}-\frac{29}{18(x-1)^5}-\frac{640}{9(x-2)^6}+\frac{5}{4}\Bigg)H(0;\alpha_0)+\Bigg(\frac{x\alpha_0^5}{2}+\frac{\alpha_0^5}{x-2}-\frac{\alpha_0^5}{2(x-1)}-\frac{19x\alpha_0^4}{6}-\frac{10\alpha_0^4}{3(x-2)}+\frac{13\alpha_0^4}{6(x-1)}+\frac{10\alpha_0^4}{3(x-2)^2}-$$
$$\frac{2\alpha_0^4}{3(x-1)^2}+\frac{\alpha_0^4}{3}+\frac{26x\alpha_0^3}{3}+\frac{10\alpha_0^3}{3(x-2)}-\frac{11\alpha_0^3}{3(x-1)}-\frac{20\alpha_0^3}{3(x-2)^2}+\frac{7\alpha_0^3}{3(x-1)^2}+\frac{40\alpha_0^3}{3(x-2)^3}-\frac{\alpha_0^3}{(x-1)^3}-2\alpha_0^3-14x\alpha_0^2+\frac{3\alpha_0^2}{x-1}-$$
$$\frac{3\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}+\frac{80\alpha_0^2}{(x-2)^4}-\frac{2\alpha_0^2}{(x-1)^4}+6\alpha_0^2+\frac{73x\alpha_0}{6}-\frac{5\alpha_0}{3(x-2)}-\frac{7\alpha_0}{6(x-1)}+\frac{20\alpha_0}{3(x-2)^2}+\frac{5\alpha_0}{3(x-1)^2}-\frac{40\alpha_0}{(x-2)^3}-\frac{3\alpha_0}{(x-1)^3}-$$
$$\frac{320\alpha_0}{(x-2)^4}-\frac{320\alpha_0}{(x-2)^5}-\frac{10\alpha_0}{3}-\frac{25x}{6}+\frac{2}{3(x-2)}+\frac{1}{6(x-1)}-\frac{10}{3(x-2)^2}-\frac{1}{3(x-1)^2}+\frac{80}{3(x-2)^3}+\frac{1}{(x-1)^3}+\frac{240}{(x-2)^4}+\frac{2}{(x-1)^4}+$$
$$\frac{320}{(x-2)^5}-1\Bigg)H(1;\alpha_0)+\Bigg(\frac{2x\alpha_0}{3}+\frac{208\alpha_0}{3(x-2)^4}-\frac{8\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}+\frac{8\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{208}{3(x-2)^4}+\frac{8}{3(x-1)^4}-$$
$$\frac{736}{3(x-2)^5}+\frac{8}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Bigg)H(0;\alpha_0)\,H(1;x)+\Bigg(-\frac{x\alpha_0^5}{6}-\frac{\alpha_0^5}{3(x-2)}+\frac{\alpha_0^5}{6(x-1)}-\frac{\alpha_0^5}{4}+\frac{19x\alpha_0^4}{18}+\frac{17\alpha_0^4}{18(x-2)}-$$
$$\frac{13\alpha_0^4}{18(x-1)}-\frac{10\alpha_0^4}{9(x-2)^2}+\frac{2\alpha_0^4}{9(x-1)^2}+\frac{41\alpha_0^4}{36}-\frac{26x\alpha_0^3}{9}-\frac{4\alpha_0^3}{9(x-2)}+\frac{11\alpha_0^3}{9(x-1)}+\frac{14\alpha_0^3}{9(x-2)^2}-\frac{7\alpha_0^3}{9(x-1)^2}-\frac{40\alpha_0^3}{9(x-2)^3}+\frac{\alpha_0^3}{3(x-1)^3}-$$
$$\frac{11\alpha_0^3}{6}+\frac{14x\alpha_0^2}{3}-\frac{\alpha_0^2}{x-2}-\frac{\alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-2)^2}+\frac{\alpha_0^2}{(x-1)^2}-\frac{4\alpha_0^2}{(x-2)^3}-\frac{\alpha_0^2}{(x-1)^3}-\frac{80\alpha_0^2}{3(x-2)^4}+\frac{2\alpha_0^2}{3(x-1)^4}+\frac{\alpha_0^2}{2}-\frac{73x\alpha_0}{18}-\frac{32\alpha_0}{9(x-2)}+$$
$$\frac{37\alpha_0}{6(x-1)}+\frac{8\alpha_0}{9(x-2)^2}-\frac{13\alpha_0}{9(x-1)^2}+\frac{16\alpha_0}{(x-2)^3}+\frac{23\alpha_0}{18(x-1)^3}+\frac{176\alpha_0}{(x-2)^4}+\frac{55\alpha_0}{36(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}-\frac{29\alpha_0}{18(x-1)^5}-\frac{29\alpha_0}{36}+\frac{25x}{18}+$$
$$\Bigg(-\frac{4\alpha_0}{3(x-1)^4}+\frac{4\alpha_0}{3(x-1)^5}+\frac{4}{3(x-1)^4}+\frac{4}{3(x-1)^5}\Bigg)H(0;\alpha_0)+\Bigg(\frac{2\alpha_0}{(x-1)^4}-\frac{2\alpha_0}{(x-1)^5}-\frac{2}{(x-1)^4}-\frac{2}{(x-1)^5}\Bigg)H(1;\alpha_0)-$$
$$\frac{40}{9(x-2)}+\frac{13}{3(x-1)}+\frac{56}{9(x-2)^2}-\frac{7}{18(x-1)^2}-\frac{160}{9(x-2)^3}-\frac{2}{9(x-1)^3}-\frac{416}{3(x-2)^4}-\frac{85}{36(x-1)^4}-\frac{640}{3(x-2)^5}-\frac{29}{18(x-1)^5}+$$
$$\frac{5}{4}\Bigg)H(c_1(\alpha_0);x)+\Bigg(\frac{160\alpha_0}{9(x-2)^4}+\frac{320\alpha_0}{9(x-2)^5}+\Bigg(-\frac{320\alpha_0}{3(x-2)^4}-\frac{640\alpha_0}{3(x-2)^5}+\frac{320}{3(x-2)^4}+\frac{1280}{3(x-2)^5}+\frac{1280}{3(x-2)^6}\Bigg)H(0;\alpha_0)+$$
$$\Bigg(\frac{160\alpha_0}{(x-2)^4}+\frac{320\alpha_0}{(x-2)^5}-\frac{160}{(x-2)^4}-\frac{640}{(x-2)^5}-\frac{640}{(x-2)^6}\Bigg)H(1;\alpha_0)-\frac{160}{9(x-2)^4}-\frac{640}{9(x-2)^5}-\frac{640}{9(x-2)^6}\Bigg)H(c_2(\alpha_0);x)+$$
$$\Bigg(-\frac{4x\alpha_0}{3}-\frac{320\alpha_0}{3(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-\frac{640\alpha_0}{3(x-2)^5}+\frac{4\alpha_0}{3(x-1)^5}+\frac{8\alpha_0}{3}+\frac{4x}{3}+\frac{320}{3(x-2)^4}+\frac{4}{3(x-1)^4}+\frac{1280}{3(x-2)^5}+\frac{4}{3(x-1)^5}+$$
$$\frac{1280}{3(x-2)^6}\Bigg)H(0,0;\alpha_0)+\Bigg(-\frac{4x\alpha_0}{3}+\frac{320\alpha_0}{3(x-2)^4}+\frac{4\alpha_0}{3(x-1)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}+\frac{8\alpha_0}{3}+\frac{4x}{3}-\frac{320}{3(x-2)^4}-\frac{4}{3(x-1)^4}-$$
$$\frac{1280}{3(x-2)^5}-\frac{4}{3(x-1)^5}-\frac{1280}{3(x-2)^6}\Bigg)H(0,0;x)+\Bigg(2x\alpha_0+\frac{160\alpha_0}{(x-2)^4}+\frac{2\alpha_0}{(x-1)^4}+\frac{320\alpha_0}{(x-2)^5}-\frac{2\alpha_0}{(x-1)^5}-4\alpha_0-2x-$$

$$\frac{160}{(x-2)^4}-\frac{2}{(x-1)^4}-\frac{640}{(x-2)^5}-\frac{2}{(x-1)^5}-\frac{640}{(x-2)^6}\Big)H(0,1;\alpha_0)+\Big(\frac{2x\alpha_0}{3}+\frac{208\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{320\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-$$
$$\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{208}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{736}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{320\alpha_0}{3(x-2)^4}-\frac{640\alpha_0}{3(x-2)^5}+$$
$$\frac{320}{3(x-2)^4}+\frac{1280}{3(x-2)^5}+\frac{1280}{3(x-2)^6}\Big)H(0,c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{208\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3(x-2)^5}-\frac{8\alpha_0}{3(x-1)^5}+$$
$$\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{208}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{736}{3(x-2)^5}-\frac{8}{3(x-1)^5}+\frac{640}{3(x-2)^6}\Big)H(1,0;x)+\Big(\frac{2x\alpha_0}{3}+\frac{208\alpha_0}{3(x-2)^4}-\frac{8\alpha_0}{3(x-1)^4}+$$
$$\frac{320\alpha_0}{3(x-2)^5}+\frac{8\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{208}{3(x-2)^4}+\frac{8}{3(x-1)^4}-\frac{736}{3(x-2)^5}+\frac{8}{3(x-1)^5}-\frac{640}{3(x-2)^6}\Big)H(1,c_1(\alpha_0);x)+\Big(-$$
$$\frac{800\alpha_0}{3(x-2)^4}-\frac{1600\alpha_0}{3(x-2)^5}+\frac{800}{3(x-2)^4}+\frac{3200}{3(x-2)^5}+\frac{3200}{3(x-2)^6}\Big)H(2,0;x)+\Big(\frac{800\alpha_0}{3(x-2)^4}+\frac{1600\alpha_0}{3(x-2)^5}-\frac{800}{3(x-2)^4}-\frac{3200}{3(x-2)^5}-$$
$$\frac{3200}{3(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(-\frac{2\alpha_0}{3(x-1)^4}+\frac{2\alpha_0}{3(x-1)^5}+\frac{2}{3(x-1)^4}+\frac{2}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-$$
$$\frac{208\alpha_0}{3(x-2)^4}-\frac{320\alpha_0}{3(x-2)^5}+\frac{208}{3(x-2)^4}+\frac{736}{3(x-2)^5}+\frac{640}{3(x-2)^6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+H(0;x)\Big(\frac{29x\alpha_0}{18}+\frac{32\alpha_0}{9(x-2)}-$$
$$\frac{37\alpha_0}{6(x-1)}-\frac{8\alpha_0}{9(x-2)^2}+\frac{13\alpha_0}{9(x-1)^2}-\frac{16\alpha_0}{(x-2)^3}-\frac{23\alpha_0}{18(x-1)^3}-\frac{1120\alpha_0}{9(x-2)^4}-\frac{31\alpha_0}{36(x-1)^4}-\frac{320\alpha_0}{9(x-2)^5}+\frac{29\alpha_0}{18(x-1)^5}-\frac{320\ln 2\,\alpha_0}{3(x-2)^4}-$$
$$\frac{640\ln 2\,\alpha_0}{3(x-2)^5}-\frac{71\alpha_0}{36}-\frac{29x}{18}+\frac{40}{9(x-2)}-\frac{13}{3(x-1)}-\frac{56}{9(x-2)^2}+\frac{7}{18(x-1)^2}+\frac{160}{9(x-2)^3}+\frac{2}{9(x-1)^3}+\frac{1408}{9(x-2)^4}+\frac{85}{36(x-1)^4}+$$
$$\frac{2560}{9(x-2)^5}+\frac{29}{18(x-1)^5}+\frac{640}{9(x-2)^6}+\frac{320\ln 2}{3(x-2)^4}+\frac{1280\ln 2}{3(x-2)^5}+\frac{1280\ln 2}{3(x-2)^6}-\frac{5}{4}\Big)+H(2;x)\Big(\frac{800\ln 2\,\alpha_0}{3(x-2)^4}+\frac{1600\ln 2\,\alpha_0}{3(x-2)^5}+$$
$$\Big(\frac{800\alpha_0}{3(x-2)^4}+\frac{1600\alpha_0}{3(x-2)^5}-\frac{800}{3(x-2)^4}-\frac{3200}{3(x-2)^5}-\frac{3200}{3(x-2)^6}\Big)H(0;\alpha_0)-\frac{800\ln 2}{3(x-2)^4}-\frac{3200\ln 2}{3(x-2)^5}-\frac{3200\ln 2}{3(x-2)^6}\Big)-\frac{4\pi^2}{9(x-2)^4}-$$
$$\frac{\pi^2}{9(x-1)^4}-\frac{88\pi^2}{9(x-2)^5}-\frac{\pi^2}{9(x-1)^5}-\frac{160\pi^2}{9(x-2)^6}-\frac{160\ln^2 2}{3(x-2)^4}-\frac{640\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3(x-2)^6}-\frac{160\ln 2}{9(x-2)^4}-\frac{640\ln 2}{9(x-2)^5}-\frac{640\ln 2}{9(x-2)^6}\},$$

$$b_2^{(-1,2)}=$$
$$\frac{1}{\alpha_0 x-x-2\alpha_0}\Big\{-\frac{1}{72}\pi^2 x\alpha_0^5+\frac{301x\alpha_0^5}{432}-\frac{\pi^2\alpha_0^5}{36(x-2)}+\frac{673\alpha_0^5}{216(x-2)}+\frac{\pi^2\alpha_0^5}{72(x-1)}-\frac{301\alpha_0^5}{432(x-1)}+\frac{31\alpha_0^5}{36}+\frac{19}{216}\pi^2 x\alpha_0^4-\frac{6967x\alpha_0^4}{1296}+$$
$$\frac{5\pi^2\alpha_0^4}{54(x-2)}-\frac{2345\alpha_0^4}{324(x-2)}-\frac{13\pi^2\alpha_0^4}{216(x-1)}+\frac{5251\alpha_0^4}{1296(x-1)}-\frac{5\pi^2\alpha_0^4}{54(x-2)^2}+\frac{5405\alpha_0^4}{324(x-2)^2}+\frac{\pi^2\alpha_0^4}{54(x-1)^2}-\frac{613\alpha_0^4}{324(x-1)^2}-\frac{\pi^2\alpha_0^4}{108}-\frac{299\alpha_0^4}{162}-$$
$$\frac{13}{54}\pi^2 x\,\alpha_0^3+\frac{3413x\alpha_0^3}{162}-\frac{5\pi^2\alpha_0^3}{54(x-2)}-\frac{895\alpha_0^3}{324(x-2)}+\frac{11\pi^2\alpha_0^3}{108(x-1)}-\frac{5807\alpha_0^3}{648(x-1)}+\frac{5\pi^2\alpha_0^3}{27(x-2)^2}-\frac{115\alpha_0^3}{81(x-2)^2}-\frac{7\pi^2\alpha_0^3}{108(x-1)^2}+$$
$$\frac{14261\alpha_0^3}{1296(x-1)^2}-\frac{10\pi^2\alpha_0^3}{27(x-2)^3}+\frac{10580\alpha_0^3}{81(x-2)^3}+\frac{\pi^2\alpha_0^3}{36(x-1)^3}-\frac{1411\alpha_0^3}{216(x-1)^3}+\frac{\pi^2\alpha_0^3}{18}-\frac{4837\alpha_0^3}{432}+\frac{7}{18}\pi^2 x\,\alpha_0^2-\frac{4571x\alpha_0^2}{54}+\frac{545\alpha_0^2}{18(x-2)}-$$
$$\frac{\pi^2\alpha_0^2}{12(x-1)}-\frac{121\alpha_0^2}{36(x-1)}-\frac{2075\alpha_0^2}{18(x-2)^2}+\frac{\pi^2\alpha_0^2}{12(x-1)^2}-\frac{3577\alpha_0^2}{144(x-1)^2}+\frac{7600\alpha_0^2}{9(x-2)^3}-\frac{\pi^2\alpha_0^2}{12(x-1)^3}+\frac{524\alpha_0^2}{9(x-1)^3}-\frac{20\pi^2\alpha_0^2}{9(x-2)^4}+\frac{66760\alpha_0^2}{27(x-2)^4}+$$
$$\frac{\pi^2\alpha_0^2}{18(x-1)^4}-\frac{5047\alpha_0^2}{108(x-1)^4}-\frac{\pi^2\alpha_0^2}{6}+\frac{17483\alpha_0^2}{144}-\frac{7}{8}\pi^2 x\alpha_0+\frac{5525x\alpha_0}{81}-\frac{26\pi^2\alpha_0}{9(x-2)}-\frac{17\alpha_0}{9(x-2)}+\frac{745\pi^2\alpha_0}{216(x-1)}-\frac{467\alpha_0}{24(x-1)}+$$
$$\frac{10\pi^2\alpha_0}{3(x-2)^2}+\frac{565\alpha_0}{9(x-2)^2}-\frac{8\pi^2\alpha_0}{9(x-1)^2}+\frac{91\alpha_0}{8(x-1)^2}-\frac{8\pi^2\alpha_0}{3(x-2)^3}-\frac{7240\alpha_0}{9(x-2)^3}+\frac{79\pi^2\alpha_0}{108(x-1)^3}-\frac{689\alpha_0}{24(x-1)^3}+\frac{920\pi^2\alpha_0}{27(x-2)^4}-\frac{133520\alpha_0}{27(x-2)^4}+$$
$$\frac{5\pi^2\alpha_0}{54(x-1)^4}-\frac{5047\alpha_0}{108(x-1)^4}+\frac{400\pi^2\alpha_0}{27(x-2)^5}-\frac{154240\alpha_0}{27(x-2)^5}-\frac{29\pi^2\alpha_0}{54(x-1)^5}+\frac{17}{12}x\zeta_3\,\alpha_0+\frac{224\zeta_3\alpha_0}{3(x-2)^4}-\frac{7\zeta_3\alpha_0}{4(x-1)^4}+\frac{280\zeta_3\alpha_0}{3(x-2)^5}+$$
$$\frac{7\zeta_3\alpha_0}{4(x-1)^5}-\frac{17}{6}\zeta_3\alpha_0+\frac{640\ln^3 2\,\alpha_0}{9(x-2)^4}+\frac{1280\ln^3 2\,\alpha_0}{9(x-2)^5}+\frac{320\ln^2 2\,\alpha_0}{9(x-2)^4}+\frac{640\ln^2 2\,\alpha_0}{9(x-2)^5}-\frac{1}{6}\pi^2 x\ln 2\,\alpha_0-\frac{32\pi^2\ln 2\,\alpha_0}{3(x-2)^4}+$$
$$\frac{320\ln 2\,\alpha_0}{27(x-2)^4}+\frac{\pi^2\ln 2\,\alpha_0}{6(x-1)^4}+\frac{80\pi^2\ln 2\,\alpha_0}{3(x-2)^5}+\frac{640\ln 2\,\alpha_0}{27(x-2)^5}-\frac{\pi^2\ln 2\,\alpha_0}{6(x-1)^5}+\frac{1}{3}\pi^2\ln 2\,\alpha_0+\frac{53\pi^2\alpha_0}{72}+\frac{1669\alpha_0}{648}+\frac{47\pi^2 x}{72}+\frac{4x}{81}+$$
$$\Big(-\frac{19x\alpha_0^5}{18}-\frac{31\alpha_0^5}{9(x-2)}+\frac{19\alpha_0^5}{18(x-1)}-\frac{2\alpha_0^5}{3}+\frac{131x\alpha_0^4}{18}+\frac{10\alpha_0^4}{x-2}-\frac{95\alpha_0^4}{18(x-1)}-\frac{130\alpha_0^4}{9(x-2)^2}+\frac{2\alpha_0^4}{(x-1)^2}+\frac{4\alpha_0^4}{3}-\frac{208x\alpha_0^3}{9}-\frac{50\alpha_0^3}{9(x-2)}+$$
$$\frac{95\alpha_0^3}{9(x-1)}+\frac{160\alpha_0^3}{9(x-2)^2}-\frac{53\alpha_0^3}{6(x-1)^2}-\frac{80\alpha_0^3}{(x-2)^3}+\frac{41\alpha_0^3}{9(x-1)^3}+\frac{121\alpha_0^3}{18}+\frac{160x\alpha_0^2}{3}-\frac{92\alpha_0^2}{9(x-2)}-\frac{26\alpha_0^2}{3(x-1)}+\frac{36\alpha_0^2}{(x-2)^2}+\frac{271\alpha_0^2}{18(x-1)^2}-$$
$$\frac{1600\alpha_0^2}{9(x-2)^3}-\frac{68\alpha_0^2}{3(x-1)^3}-\frac{7520\alpha_0^2}{9(x-2)^4}+\frac{154\alpha_0^2}{9(x-1)^4}-\frac{857\alpha_0^2}{18}-\frac{1}{18}\pi^2 x\alpha_0-\frac{5255x\alpha_0}{108}-\frac{812\alpha_0}{9(x-2)}+\frac{239\alpha_0}{2(x-1)}+\frac{448\alpha_0}{9(x-2)^2}-$$
$$\frac{18\alpha_0}{(x-1)^2}+\frac{3248\alpha_0}{9(x-2)^3}+\frac{164\alpha_0}{9(x-1)^3}-\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{76160\alpha_0}{27(x-2)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{4877\alpha_0}{216(x-1)^4}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{62080\alpha_0}{27(x-2)^5}+\frac{\pi^2\alpha_0}{18(x-1)^5}-$$
$$\frac{1351\alpha_0}{108(x-1)^5}+\frac{\pi^2\alpha_0}{9}+\frac{809\alpha_0}{216}+\frac{\pi^2 x}{18}+\frac{1319x}{108}-\frac{92}{x-2}+\frac{1133}{12(x-1)}+\frac{1040}{9(x-2)^2}-\frac{223}{36(x-1)^2}-\frac{3008}{9(x-2)^3}-\frac{103}{36(x-1)^3}+$$
$$\frac{40\pi^2}{9(x-2)^4}-\frac{41120}{27(x-2)^4}+\frac{\pi^2}{18(x-1)^4}-\frac{4223}{216(x-1)^4}+\frac{160\pi^2}{9(x-2)^5}-\frac{62720}{27(x-2)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{1351}{108(x-1)^5}+\frac{160\pi^2}{9(x-2)^6}-$$
$$\frac{1280}{27(x-2)^6}+\frac{275}{24}\Big)H(0;\alpha_0)+\Big(\frac{19x\alpha_0^5}{12}+\frac{31\alpha_0^5}{6(x-2)}-\frac{19\alpha_0^5}{12(x-1)}+\alpha_0^5-\frac{131x\alpha_0^4}{12}-\frac{15\alpha_0^4}{x-2}+\frac{95\alpha_0^4}{12(x-1)}+\frac{65\alpha_0^4}{3(x-2)^2}-\frac{3\alpha_0^4}{(x-1)^2}-$$
$$2\alpha_0^4+\frac{104x\alpha_0^3}{3}+\frac{25\alpha_0^3}{3(x-2)}-\frac{95\alpha_0^3}{6(x-1)}-\frac{80\alpha_0^3}{3(x-2)^2}+\frac{53\alpha_0^3}{4(x-1)^2}+\frac{120\alpha_0^3}{(x-2)^3}-\frac{41\alpha_0^3}{6(x-1)^3}-\frac{121\alpha_0^3}{12}-80x\,\alpha_0^2+\frac{46\alpha_0^2}{3(x-2)}+\frac{13\alpha_0^2}{x-1}-$$

$$\frac{54\alpha_0^2}{(x-2)^2} - \frac{271\alpha_0^2}{12(x-1)^2} + \frac{800\alpha_0^2}{3(x-2)^3} + \frac{34\alpha_0^2}{(x-1)^3} + \frac{3760\alpha_0^2}{3(x-2)^4} - \frac{77\alpha_0^2}{3(x-1)^4} + \frac{857\alpha_0^2}{12} + \frac{367x\alpha_0}{4} - \frac{109\alpha_0}{6(x-2)} - \frac{103\alpha_0}{12(x-1)} + \frac{296\alpha_0}{3(x-2)^2} +$$

$$\frac{205\alpha_0}{12(x-1)^2} - \frac{888\alpha_0}{(x-2)^3} - \frac{89\alpha_0}{2(x-1)^3} - \frac{12640\alpha_0}{3(x-2)^4} - \frac{10240\alpha_0}{3(x-2)^5} - \frac{233\alpha_0}{4} - \frac{445x}{12} + \frac{13}{3(x-2)} + \frac{61}{12(x-1)} - \frac{119}{3(x-2)^2} - \frac{19}{4(x-1)^2} +$$

$$\frac{1504}{3(x-2)^3} + \frac{52}{3(x-1)^3} + \frac{2960}{(x-2)^4} + \frac{77}{3(x-1)^4} + \frac{10240}{3(x-2)^5} - \frac{25}{12}\Big) H(1;\alpha_0) + \Big(\frac{4x\alpha_0^5}{3} + \frac{8\alpha_0^5}{3(x-2)} - \frac{4\alpha_0^5}{3(x-1)} - \frac{76x\alpha_0^4}{9} - \frac{80\alpha_0^4}{9(x-2)} +$$

$$\frac{52\alpha_0^4}{9(x-1)} + \frac{80\alpha_0^4}{9(x-2)^2} - \frac{16\alpha_0^4}{9(x-1)^2} + \frac{8\alpha_0^4}{9} + \frac{208x\alpha_0^3}{9} + \frac{80\alpha_0^3}{9(x-2)} - \frac{88\alpha_0^3}{9(x-1)} - \frac{160\alpha_0^3}{9(x-2)^2} + \frac{56\alpha_0^3}{9(x-1)^2} + \frac{320\alpha_0^3}{9(x-2)^3} - \frac{8\alpha_0^3}{3(x-1)^3} -$$

$$\frac{16\alpha_0^3}{3} - \frac{112x\alpha_0^2}{3} + \frac{8\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{8\alpha_0^2}{(x-1)^3} + \frac{640\alpha_0^2}{3(x-2)^4} - \frac{16\alpha_0^2}{3(x-1)^4} + 16\alpha_0^2 + 26x\alpha_0 + \frac{128\alpha_0}{9(x-2)} - \frac{74\alpha_0}{3(x-1)} - \frac{32\alpha_0}{9(x-2)^2} +$$

$$\frac{52\alpha_0}{9(x-1)^2} - \frac{64\alpha_0}{(x-2)^3} - \frac{46\alpha_0}{9(x-1)^3} - \frac{8320\alpha_0}{9(x-2)^4} - \frac{79\alpha_0}{9(x-1)^4} - \frac{8960\alpha_0}{9(x-2)^5} + \frac{58\alpha_0}{9(x-1)^5} + \frac{19\alpha_0}{3} - \frac{14x}{3} + \frac{160}{9(x-2)} - \frac{52}{3(x-1)} -$$

$$\frac{224}{9(x-2)^2} + \frac{14}{9(x-1)^2} + \frac{640}{9(x-2)^3} + \frac{8}{9(x-1)^3} + \frac{5632}{9(x-2)^4} + \frac{85}{9(x-1)^4} + \frac{10240}{9(x-2)^5} + \frac{58}{9(x-1)^5} + \frac{2560}{9(x-2)^6} - 5\Big) H(0,0;\alpha_0) +$$

$$\Big(-2x\alpha_0^5 - \frac{4\alpha_0^5}{x-2} + \frac{2\alpha_0^5}{x-1} + \frac{38x\alpha_0^4}{3} + \frac{40\alpha_0^4}{3(x-2)} - \frac{26\alpha_0^4}{3(x-1)} - \frac{40\alpha_0^4}{3(x-2)^2} + \frac{8\alpha_0^4}{3(x-1)^2} - \frac{4\alpha_0^4}{3} - \frac{104x\alpha_0^3}{3} - \frac{40\alpha_0^3}{3(x-2)} + \frac{44\alpha_0^3}{3(x-1)} +$$

$$\frac{80\alpha_0^3}{3(x-2)^2} - \frac{28\alpha_0^3}{3(x-1)^2} - \frac{160\alpha_0^3}{3(x-2)^3} + \frac{4\alpha_0^3}{(x-1)^3} + 8\alpha_0^3 + 56x\alpha_0^2 - \frac{12\alpha_0^2}{x-1} + \frac{12\alpha_0^2}{(x-1)^2} - \frac{12\alpha_0^2}{(x-1)^3} - \frac{320\alpha_0^2}{(x-2)^4} + \frac{8\alpha_0^2}{(x-1)^4} - 24\alpha_0^2 -$$

$$39x\alpha_0 - \frac{64\alpha_0}{3(x-2)} + \frac{37\alpha_0}{x-1} + \frac{16\alpha_0}{3(x-2)^2} - \frac{26\alpha_0}{3(x-1)^2} + \frac{96\alpha_0}{(x-2)^3} + \frac{23\alpha_0}{3(x-1)^3} + \frac{4160\alpha_0}{3(x-2)^4} + \frac{79\alpha_0}{6(x-1)^4} + \frac{4480\alpha_0}{3(x-2)^5} - \frac{29\alpha_0}{3(x-1)^5} -$$

$$\frac{19\alpha_0}{2} + 7x - \frac{80}{3(x-2)} + \frac{26}{x-1} + \frac{112}{3(x-2)^2} - \frac{7}{3(x-1)^2} - \frac{320}{3(x-2)^3} - \frac{4}{3(x-1)^3} - \frac{2816}{3(x-2)^4} - \frac{85}{6(x-1)^4} - \frac{5120}{3(x-2)^5} -$$

$$\frac{29}{3(x-1)^5} - \frac{1280}{3(x-2)^6} + \frac{15}{2}\Big) H(0,1;\alpha_0) + H(1;x)\Big(\frac{1}{9}\pi^2 x\alpha_0 + \frac{32\pi^2\alpha_0}{3(x-2)^4} - \frac{8\pi^2\alpha_0}{9(x-1)^4} + \frac{80\pi^2\alpha_0}{3(x-2)^5} + \frac{8\pi^2\alpha_0}{9(x-1)^5} - \frac{2\pi^2\alpha_0}{9} -$$

$$\frac{\pi^2 x}{9} + \Big(\frac{29x\alpha_0}{9} + \frac{406\alpha_0}{9(x-2)} - \frac{166\alpha_0}{3(x-1)} - \frac{424\alpha_0}{9(x-2)^2} + \frac{193\alpha_0}{18(x-1)^2} + \frac{32\alpha_0}{(x-2)^3} - \frac{53\alpha_0}{9(x-1)^3} - \frac{4000\alpha_0}{9(x-2)^4} - \frac{175\alpha_0}{18(x-1)^4} + \frac{640\alpha_0}{9(x-2)^5} +$$

$$\frac{116\alpha_0}{9(x-1)^5} + \frac{2\alpha_0}{9} - \frac{29x}{9} + \frac{326}{9(x-2)} - \frac{118}{3(x-1)} - \frac{388}{9(x-2)^2} + \frac{95}{18(x-1)^2} + \frac{560}{9(x-2)^3} + \frac{4}{9(x-1)^3} + \frac{3424}{9(x-2)^4} + \frac{289}{18(x-1)^4} +$$

$$\frac{7360}{9(x-2)^5} + \frac{116}{9(x-1)^5} - \frac{1280}{9(x-2)^6} - \frac{20}{3}\Big) H(0;\alpha_0) + \Big(-\frac{8x\alpha_0}{3} - \frac{832\alpha_0}{3(x-2)^4} + \frac{32\alpha_0}{3(x-1)^4} - \frac{1280\alpha_0}{3(x-2)^5} - \frac{32\alpha_0}{3(x-1)^5} + \frac{16\alpha_0}{3} +$$

$$\frac{8x}{3} + \frac{832}{3(x-2)^4} - \frac{32}{3(x-1)^4} + \frac{2944}{3(x-2)^5} - \frac{32}{3(x-1)^5} + \frac{2560}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big(4x\alpha_0 + \frac{416\alpha_0}{(x-2)^4} - \frac{16\alpha_0}{(x-1)^4} + \frac{640\alpha_0}{(x-2)^5} +$$

$$\frac{16\alpha_0}{(x-1)^5} - 8\alpha_0 - 4x - \frac{416}{(x-2)^4} + \frac{16}{(x-1)^4} - \frac{1472}{(x-2)^5} + \frac{16}{(x-1)^5} - \frac{1280}{(x-2)^6}\Big) H(0,1;\alpha_0) - \frac{32\pi^2}{3(x-2)^4} + \frac{8\pi^2}{9(x-1)^4} - \frac{48\pi^2}{(x-2)^5} +$$

$$\frac{8\pi^2}{9(x-1)^5} - \frac{160\pi^2}{3(x-2)^6}\Big) + \Big(-\frac{20x\alpha_0}{3} - \frac{1984\alpha_0}{3(x-2)^4} + \frac{20\alpha_0}{3(x-1)^4} - \frac{3200\alpha_0}{3(x-2)^5} - \frac{20\alpha_0}{3(x-1)^5} + \frac{40\alpha_0}{3} + \frac{20x}{3} + \frac{1984}{3(x-2)^4} - \frac{20}{3(x-1)^4} +$$

$$\frac{7168}{3(x-2)^5} - \frac{20}{3(x-1)^5} + \frac{6400}{3(x-2)^6}\Big) H(0;\alpha_0) H(0,1;x) + \Big(-\frac{\alpha_0^5}{2} - \frac{\alpha_0^4}{3(x-2)} + \frac{5\alpha_0^4}{2} + \frac{4\alpha_0^3}{3(x-2)} - \frac{4\alpha_0^3}{3(x-2)^2} - 5\alpha_0^3 -$$

$$\frac{2\alpha_0^2}{x-2} + \frac{4\alpha_0^2}{(x-2)^2} - \frac{8\alpha_0^2}{(x-2)^3} + 5\alpha_0^2 + \frac{29x\alpha_0}{9} + \frac{160\alpha_0}{9(x-2)} - \frac{62\alpha_0}{3(x-1)} - \frac{184\alpha_0}{9(x-2)^2} + \frac{97\alpha_0}{18(x-1)^2} + \frac{16\alpha_0}{(x-2)^3} - \frac{38\alpha_0}{9(x-1)^3} - \frac{832\alpha_0}{9(x-2)^4} -$$

$$\frac{5\alpha_0}{9(x-1)^4} + \frac{640\alpha_0}{9(x-2)^5} + \frac{29\alpha_0}{9(x-1)^5} - \frac{113\alpha_0}{18} - \frac{29x}{9} + \Big(-\frac{8x\alpha_0}{3} - \frac{832\alpha_0}{3(x-2)^4} + \frac{8\alpha_0}{3(x-1)^4} - \frac{1280\alpha_0}{3(x-2)^5} - \frac{8\alpha_0}{3(x-1)^5} + \frac{16\alpha_0}{3} + \frac{8x}{3} +$$

$$\frac{832}{3(x-2)^4} - \frac{8}{3(x-1)^4} + \frac{2944}{3(x-2)^5} - \frac{8}{3(x-1)^5} + \frac{2560}{3(x-2)^6}\Big) H(0;\alpha_0) + \Big(4x\alpha_0 + \frac{416\alpha_0}{(x-2)^4} - \frac{4\alpha_0}{(x-1)^4} + \frac{640\alpha_0}{(x-2)^5} + \frac{4\alpha_0}{(x-1)^5} -$$

$$8\alpha_0 - 4x - \frac{416}{(x-2)^4} + \frac{4}{(x-1)^4} - \frac{1472}{(x-2)^5} + \frac{4}{(x-1)^5} - \frac{1280}{(x-2)^6}\Big) H(1;\alpha_0) + \frac{104}{9(x-2)} - \frac{13}{x-1} - \frac{136}{9(x-2)^2} + \frac{41}{18(x-1)^2} +$$

$$\frac{224}{9(x-2)^3} + \frac{10}{9(x-1)^3} + \frac{832}{9(x-2)^4} + \frac{53}{9(x-1)^4} + \frac{1600}{9(x-2)^5} + \frac{29}{9(x-1)^5} - \frac{1280}{9(x-2)^6} - \frac{13}{6}\Big) H(0,c_1(\alpha_0);x) + \Big(-$$

$$\frac{640\alpha_0}{9(x-2)^4} - \frac{1280\alpha_0}{9(x-2)^5} + \Big(\frac{1280\alpha_0}{3(x-2)^4} + \frac{2560\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^4} - \frac{5120}{3(x-2)^5} - \frac{5120}{3(x-2)^6}\Big) H(0;\alpha_0) + \Big(-\frac{640\alpha_0}{(x-2)^4} - \frac{1280\alpha_0}{(x-2)^5} +$$

$$\frac{640}{(x-2)^4} + \frac{2560}{(x-2)^5} + \frac{2560}{(x-2)^6}\Big) H(1;\alpha_0) + \frac{640}{9(x-2)^4} + \frac{2560}{9(x-2)^5} + \frac{2560}{9(x-2)^6}\Big) H(0,c_2(\alpha_0);x) + \Big(-2x\alpha_0^5 - \frac{4\alpha_0^5}{x-2} +$$

$$\frac{2\alpha_0^5}{x-1} + \frac{38x\alpha_0^4}{3} + \frac{40\alpha_0^4}{3(x-2)} - \frac{26\alpha_0^4}{3(x-1)} - \frac{40\alpha_0^4}{3(x-2)^2} + \frac{8\alpha_0^4}{3(x-1)^2} - \frac{4\alpha_0^4}{3} - \frac{104x\alpha_0^3}{3} - \frac{40\alpha_0^3}{3(x-2)} + \frac{44\alpha_0^3}{3(x-1)} + \frac{80\alpha_0^3}{3(x-2)^2} - \frac{28\alpha_0^3}{3(x-1)^2} -$$

$$\frac{160\alpha_0^3}{3(x-2)^3} + \frac{4\alpha_0^3}{(x-1)^3} + 8\alpha_0^3 + 56x\alpha_0^2 - \frac{12\alpha_0^2}{x-1} + \frac{12\alpha_0^2}{(x-1)^2} - \frac{12\alpha_0^2}{(x-1)^3} - \frac{320\alpha_0^2}{(x-2)^4} + \frac{8\alpha_0^2}{(x-1)^4} - 24\alpha_0^2 - \frac{146x\alpha_0}{3} + \frac{20\alpha_0}{3(x-2)} +$$

$$\frac{14\alpha_0}{3(x-1)} - \frac{80\alpha_0}{3(x-2)^2} - \frac{20\alpha_0}{3(x-1)^2} + \frac{160\alpha_0}{(x-2)^3} + \frac{12\alpha_0}{(x-1)^3} + \frac{1280\alpha_0}{(x-2)^4} + \frac{1280\alpha_0}{(x-2)^5} + \frac{40\alpha_0}{3} + \frac{50x}{3} - \frac{8}{3(x-2)} - \frac{2}{3(x-1)} + \frac{40}{3(x-2)^2} +$$

$$\frac{4}{3(x-1)^2} - \frac{320}{3(x-2)^3} - \frac{4}{(x-1)^3} - \frac{960}{(x-2)^4} - \frac{8}{(x-1)^4} - \frac{1280}{(x-2)^5} + 4\Big) H(1,0;\alpha_0) + \Big(-\frac{29x\alpha_0}{9} - \frac{406\alpha_0}{9(x-2)} + \frac{166\alpha_0}{3(x-1)} +$$

$$\frac{424\alpha_0}{9(x-2)^2} - \frac{193\alpha_0}{18(x-1)^2} - \frac{32\alpha_0}{(x-2)^3} + \frac{53\alpha_0}{9(x-1)^3} + \frac{4000\alpha_0}{9(x-2)^4} + \frac{175\alpha_0}{18(x-1)^4} - \frac{640\alpha_0}{9(x-2)^5} - \frac{116\alpha_0}{9(x-1)^5} - \frac{2\alpha_0}{9} + \frac{29x}{9} - \frac{326}{9(x-2)} +$$

$$\frac{118}{3(x-1)} + \frac{388}{9(x-2)^2} - \frac{95}{18(x-1)^2} - \frac{560}{9(x-2)^3} - \frac{4}{9(x-1)^3} - \frac{3424}{9(x-2)^4} - \frac{289}{18(x-1)^4} - \frac{7360}{9(x-2)^5} - \frac{116}{9(x-1)^5} + \frac{1280}{9(x-2)^6} +$$

$$\frac{20}{3}\Big) H(1,0;x) + \Big(3x\alpha_0^5 + \frac{6\alpha_0^5}{x-2} - \frac{3\alpha_0^5}{x-1} - 19x\alpha_0^4 - \frac{20\alpha_0^4}{x-2} + \frac{13\alpha_0^4}{x-1} + \frac{20\alpha_0^4}{(x-2)^2} - \frac{4\alpha_0^4}{(x-1)^2} + 2\alpha_0^4 + 52x\alpha_0^3 + \frac{20\alpha_0^3}{x-2} -$$

$$\frac{22\alpha_0^3}{x-1} - \frac{40\alpha_0^3}{(x-2)^2} + \frac{14\alpha_0^3}{(x-1)^2} + \frac{80\alpha_0^3}{(x-2)^3} - \frac{6\alpha_0^3}{(x-1)^3} - 12\alpha_0^3 - 84x\alpha_0^2 + \frac{18\alpha_0^2}{x-1} - \frac{18\alpha_0^2}{(x-1)^2} + \frac{18\alpha_0^2}{(x-1)^3} + \frac{480\alpha_0^2}{(x-2)^4} - \frac{12\alpha_0^2}{(x-1)^4} +$$
$$36\alpha_0^2 + 73x\alpha_0 - \frac{10\alpha_0}{x-2} - \frac{7\alpha_0}{x-1} + \frac{40\alpha_0}{(x-2)^2} + \frac{10\alpha_0}{(x-1)^2} - \frac{240\alpha_0}{(x-2)^3} - \frac{18\alpha_0}{(x-1)^3} - \frac{1920\alpha_0}{(x-2)^4} - \frac{1920\alpha_0}{(x-2)^5} - 20\alpha_0 - 25x + \frac{4}{x-2} +$$
$$\frac{1}{x-1} - \frac{20}{(x-2)^2} - \frac{2}{(x-1)^2} + \frac{160}{(x-2)^3} + \frac{6}{(x-1)^3} + \frac{1440}{(x-2)^4} + \frac{12}{(x-1)^4} + \frac{1920}{(x-2)^5} - 6\Big) H(1,1;\alpha_0) + H(c_2(\alpha_0);x) \Big(-$$
$$\frac{40\pi^2\alpha_0}{9(x-2)^4} + \frac{320\alpha_0}{27(x-2)^4} - \frac{80\pi^2\alpha_0}{9(x-2)^5} + \frac{640\alpha_0}{27(x-2)^5} + \Big(-\frac{640\alpha_0}{9(x-2)^4} - \frac{1280\alpha_0}{9(x-2)^5} + \frac{640}{9(x-2)^4} + \frac{2560}{9(x-2)^5} + \frac{2560}{9(x-2)^6}\Big) H(0;\alpha_0) +$$
$$\Big(\frac{320\alpha_0}{3(x-2)^4} + \frac{640\alpha_0}{3(x-2)^5} - \frac{320}{3(x-2)^4} - \frac{1280}{3(x-2)^5} - \frac{1280}{3(x-2)^6}\Big) H(1;\alpha_0) + \Big(\frac{1280\alpha_0}{3(x-2)^4} + \frac{2560\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^4} - \frac{5120}{3(x-2)^5} -$$
$$\frac{5120}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big(-\frac{640\alpha_0}{(x-2)^4} - \frac{1280\alpha_0}{(x-2)^5} + \frac{640}{(x-2)^4} + \frac{2560}{(x-2)^5} + \frac{2560}{(x-2)^6}\Big) H(0,1;\alpha_0) + \Big(-\frac{640\alpha_0}{(x-2)^4} - \frac{1280\alpha_0}{(x-2)^5} +$$
$$\frac{640}{(x-2)^4} + \frac{2560}{(x-2)^5} + \frac{2560}{(x-2)^6}\Big) H(1,0;\alpha_0) + \Big(\frac{960\alpha_0}{(x-2)^4} + \frac{1920\alpha_0}{(x-2)^5} - \frac{960}{(x-2)^4} - \frac{3840}{(x-2)^5} - \frac{3840}{(x-2)^6}\Big) H(1,1;\alpha_0) +$$
$$\frac{40\pi^2}{9(x-2)^4} - \frac{320}{27(x-2)^4} + \frac{160\pi^2}{9(x-2)^5} - \frac{1280}{27(x-2)^5} + \frac{160\pi^2}{9(x-2)^6} - \frac{1280}{27(x-2)^6}\Big) + H(c_1(\alpha_0);x)\Big(-\frac{19x\alpha_0^5}{36} - \frac{31\alpha_0^5}{18(x-2)} +$$
$$\frac{19\alpha_0^5}{36(x-1)} - \frac{9\alpha_0^5}{8} + \frac{131x\alpha_0^4}{36} + \frac{137\alpha_0^4}{36(x-2)} - \frac{103\alpha_0^4}{36(x-1)} - \frac{65\alpha_0^4}{9(x-2)^2} + \frac{\alpha_0^4}{(x-1)^2} + \frac{349\alpha_0^4}{72} - \frac{104x\alpha_0^3}{9} + \frac{2\alpha_0^3}{x-2} + \frac{235\alpha_0^3}{36(x-1)} +$$
$$\frac{20\alpha_0^3}{9(x-2)^2} - \frac{43\alpha_0^3}{9(x-1)^2} - \frac{40\alpha_0^3}{(x-2)^3} + \frac{41\alpha_0^3}{18(x-1)^3} - \frac{209\alpha_0^3}{36} + \frac{80x\alpha_0^2}{3} - \frac{103\alpha_0^2}{9(x-2)} - \frac{307\alpha_0^2}{36(x-1)} + \frac{38\alpha_0^2}{(x-2)^2} + \frac{86\alpha_0^2}{9(x-1)^2} - \frac{1420\alpha_0^2}{9(x-2)^3} -$$
$$\frac{73\alpha_0^2}{6(x-1)^3} - \frac{3760\alpha_0^2}{9(x-2)^4} + \frac{77\alpha_0^2}{9(x-1)^4} - \frac{455\alpha_0^2}{36} - \frac{367x\alpha_0}{12} - \frac{802\alpha_0}{9(x-2)} + \frac{231\alpha_0}{2(x-1)} + \frac{52\alpha_0}{(x-2)^2} - \frac{140\alpha_0}{9(x-1)^2} + \frac{2864\alpha_0}{9(x-2)^3} + \frac{125\alpha_0}{9(x-1)^3} +$$
$$\frac{2160\alpha_0}{(x-2)^4} - \frac{\pi^2\alpha_0}{18(x-1)^4} + \frac{3029\alpha_0}{216(x-1)^4} + \frac{10240\alpha_0}{9(x-2)^5} + \frac{\pi^2\alpha_0}{18(x-1)^5} - \frac{1351\alpha_0}{108(x-1)^5} + \frac{235\alpha_0}{72} + \frac{445x}{36} + \Big(\frac{2x\alpha_0^5}{3} + \frac{4\alpha_0^5}{3(x-2)} -$$
$$\frac{2\alpha_0^5}{3(x-1)} + \alpha_0^5 - \frac{38x\alpha_0^4}{9} - \frac{34\alpha_0^4}{9(x-2)} + \frac{26\alpha_0^4}{9(x-1)} + \frac{40\alpha_0^4}{9(x-2)^2} - \frac{8\alpha_0^4}{9(x-1)^2} - \frac{41\alpha_0^4}{9} + \frac{104x\alpha_0^3}{9} + \frac{16\alpha_0^3}{9(x-2)} - \frac{44\alpha_0^3}{9(x-1)} - \frac{56\alpha_0^3}{9(x-2)^2} +$$
$$\frac{28\alpha_0^3}{9(x-1)^2} + \frac{160\alpha_0^3}{9(x-2)^3} - \frac{4\alpha_0^3}{3(x-1)^3} + \frac{22\alpha_0^3}{3} - \frac{56x\alpha_0^2}{3} + \frac{4\alpha_0^2}{x-2} + \frac{4\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-2)^2} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{16\alpha_0^2}{(x-2)^3} + \frac{4\alpha_0^2}{(x-1)^3} + \frac{320\alpha_0^2}{3(x-2)^4} -$$
$$\frac{8\alpha_0^2}{3(x-1)^4} - 2\alpha_0^2 + \frac{146x\alpha_0}{9} + \frac{128\alpha_0}{9(x-2)} - \frac{74\alpha_0}{3(x-1)} - \frac{32\alpha_0}{9(x-2)^2} + \frac{52\alpha_0}{9(x-1)^2} - \frac{64\alpha_0}{(x-2)^3} - \frac{46\alpha_0}{9(x-1)^3} - \frac{704\alpha_0}{(x-2)^4} - \frac{55\alpha_0}{9(x-1)^4} -$$
$$\frac{1280\alpha_0}{3(x-2)^5} + \frac{58\alpha_0}{9(x-1)^5} + \frac{29\alpha_0}{9} - \frac{50x}{9} + \frac{160}{9(x-2)} - \frac{52}{3(x-1)} - \frac{224}{9(x-2)^2} + \frac{14}{9(x-1)^2} + \frac{640}{9(x-2)^3} + \frac{8}{9(x-1)^3} + \frac{1664}{3(x-2)^4} +$$
$$\frac{85}{9(x-1)^4} + \frac{2560}{3(x-2)^5} + \frac{58}{9(x-1)^5} - 5\Big) H(0;\alpha_0) + \Big(-x\alpha_0^5 - \frac{2\alpha_0^5}{x-2} + \frac{\alpha_0^5}{x-1} - \frac{3\alpha_0^5}{2} + \frac{19x\alpha_0^4}{3} + \frac{17\alpha_0^4}{3(x-2)} - \frac{13\alpha_0^4}{3(x-1)} -$$
$$\frac{20\alpha_0^4}{3(x-2)^2} + \frac{4\alpha_0^4}{3(x-1)^2} + \frac{41\alpha_0^4}{6} - \frac{52x\alpha_0^3}{3} - \frac{8\alpha_0^3}{3(x-2)} + \frac{22\alpha_0^3}{3(x-1)} + \frac{28\alpha_0^3}{3(x-2)^2} - \frac{14\alpha_0^3}{3(x-1)^2} - \frac{80\alpha_0^3}{3(x-2)^3} + \frac{2\alpha_0^3}{(x-1)^3} - 11\alpha_0^3 +$$
$$28x\alpha_0^2 - \frac{6\alpha_0^2}{x-2} - \frac{6\alpha_0^2}{x-1} + \frac{12\alpha_0^2}{(x-2)^2} + \frac{6\alpha_0^2}{(x-1)^2} - \frac{24\alpha_0^2}{(x-2)^3} - \frac{6\alpha_0^2}{(x-1)^3} - \frac{160\alpha_0^2}{(x-2)^4} + \frac{4\alpha_0^2}{(x-1)^4} + 3\alpha_0^2 - \frac{73x\alpha_0}{3} - \frac{64\alpha_0}{3(x-2)} + \frac{37\alpha_0}{x-1} +$$
$$\frac{16\alpha_0}{3(x-2)^2} - \frac{26\alpha_0}{3(x-1)^2} + \frac{96\alpha_0}{(x-2)^3} + \frac{23\alpha_0}{3(x-1)^3} + \frac{1056\alpha_0}{(x-2)^4} + \frac{55\alpha_0}{6(x-1)^4} + \frac{640\alpha_0}{(x-2)^5} - \frac{29\alpha_0}{3(x-1)^5} - \frac{29\alpha_0}{6} + \frac{25x}{3} - \frac{80}{3(x-2)} + \frac{26}{x-1} +$$
$$\frac{112}{3(x-2)^2} - \frac{7}{3(x-1)^2} - \frac{320}{3(x-2)^3} - \frac{4}{3(x-1)^3} - \frac{832}{(x-2)^4} - \frac{85}{6(x-1)^4} - \frac{1280}{(x-2)^5} - \frac{29}{3(x-1)^5} + \frac{15}{2}\Big) H(1;\alpha_0) + \Big(\frac{16\alpha_0}{3(x-1)^4} -$$
$$\frac{16\alpha_0}{3(x-1)^5} - \frac{16}{3(x-1)^4} - \frac{16}{3(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(-\frac{8\alpha_0}{(x-1)^4} + \frac{8\alpha_0}{(x-1)^5} + \frac{8}{(x-1)^4} + \frac{8}{(x-1)^5}\Big) H(0,1;\alpha_0) + \Big(-$$
$$\frac{8\alpha_0}{(x-1)^4} + \frac{8\alpha_0}{(x-1)^5} + \frac{8}{(x-1)^4} + \frac{8}{(x-1)^5}\Big) H(1,0;\alpha_0) + \Big(\frac{12\alpha_0}{(x-1)^4} - \frac{12\alpha_0}{(x-1)^5} - \frac{12}{(x-1)^4} - \frac{12}{(x-1)^5}\Big) H(1,1;\alpha_0) - \frac{92}{x-2} +$$
$$\frac{1133}{12(x-1)} + \frac{1040}{9(x-2)^2} - \frac{223}{36(x-1)^2} - \frac{3008}{9(x-2)^3} - \frac{103}{36(x-1)^3} - \frac{13600}{9(x-2)^4} + \frac{\pi^2}{18(x-1)^4} - \frac{4223}{216(x-1)^4} - \frac{20480}{9(x-2)^5} + \frac{\pi^2}{18(x-1)^5} -$$
$$\frac{1351}{108(x-1)^5} + \frac{275}{24}\Big) + \Big(-\frac{14x\alpha_0}{3} - \frac{480\alpha_0}{(x-2)^4} + \frac{64\alpha_0}{3(x-1)^4} - \frac{800\alpha_0}{(x-2)^5} - \frac{64\alpha_0}{3(x-1)^5} + \frac{28\alpha_0}{3} + \frac{14x}{3} + \frac{480}{(x-2)^4} - \frac{64}{3(x-1)^4} +$$
$$\frac{1760}{(x-2)^5} - \frac{64}{3(x-1)^5} + \frac{1600}{(x-2)^6}\Big) H(0;\alpha_0) H(1,1;x) + \Big(\frac{29x\alpha_0}{9} + \frac{406\alpha_0}{9(x-2)} - \frac{166\alpha_0}{3(x-1)} - \frac{424\alpha_0}{9(x-2)^2} + \frac{193\alpha_0}{18(x-1)^2} + \frac{32\alpha_0}{(x-2)^3} -$$
$$\frac{53\alpha_0}{9(x-1)^3} - \frac{4000\alpha_0}{9(x-2)^4} - \frac{175\alpha_0}{18(x-1)^4} + \frac{640\alpha_0}{9(x-2)^5} + \frac{116\alpha_0}{9(x-1)^5} + \frac{2\alpha_0}{9} - \frac{29x}{9} + \Big(-\frac{8x\alpha_0}{3} - \frac{832\alpha_0}{3(x-2)^4} + \frac{32\alpha_0}{3(x-1)^4} - \frac{1280\alpha_0}{3(x-2)^5} -$$
$$\frac{32\alpha_0}{3(x-1)^5} + \frac{16\alpha_0}{3} + \frac{8x}{3} + \frac{832}{3(x-2)^4} - \frac{32}{3(x-1)^4} + \frac{2944}{3(x-2)^5} - \frac{32}{3(x-1)^5} + \frac{2560}{3(x-2)^6}\Big) H(0;\alpha_0) + \Big(4x\alpha_0 + \frac{416\alpha_0}{(x-2)^4} -$$
$$\frac{16\alpha_0}{(x-1)^4} + \frac{640\alpha_0}{(x-2)^5} + \frac{16\alpha_0}{(x-1)^5} - 8\alpha_0 - 4x - \frac{416}{(x-2)^4} + \frac{16}{(x-1)^4} - \frac{1472}{(x-2)^5} + \frac{16}{(x-1)^5} - \frac{1280}{(x-2)^6}\Big) H(1;\alpha_0) + \frac{326}{9(x-2)} -$$
$$\frac{118}{3(x-1)} - \frac{388}{9(x-2)^2} + \frac{95}{18(x-1)^2} + \frac{560}{9(x-2)^3} + \frac{4}{9(x-1)^3} + \frac{3424}{9(x-2)^4} + \frac{289}{18(x-1)^4} + \frac{7360}{9(x-2)^5} + \frac{116}{9(x-1)^5} - \frac{1280}{9(x-2)^6} -$$
$$\frac{20}{3}\Big) H(1,c_1(\alpha_0);x) + \Big(\frac{2x\alpha_0}{3} + \frac{2080\alpha_0}{3(x-2)^4} - \frac{2\alpha_0}{3(x-1)^4} + \frac{3200\alpha_0}{3(x-2)^5} + \frac{2\alpha_0}{3(x-1)^5} - \frac{4\alpha_0}{3} - \frac{2x}{3} - \frac{2080}{3(x-2)^4} + \frac{2}{3(x-1)^4} -$$
$$\frac{7360}{3(x-2)^5} + \frac{2}{3(x-1)^5} - \frac{6400}{3(x-2)^6}\Big) H(0;\alpha_0)\, H(2,1;x) + \Big(\frac{1600\alpha_0}{9(x-2)^4} + \frac{3200\alpha_0}{9(x-2)^5} + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} +$$

$$\frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0) + \Big(\frac{1600\alpha_0}{(x-2)^4} + \frac{3200\alpha_0}{(x-2)^5} - \frac{1600}{(x-2)^4} - \frac{6400}{(x-2)^5} - \frac{6400}{(x-2)^6}\Big)H(1;\alpha_0) - \frac{1600}{9(x-2)^4} -$$

$$\frac{6400}{9(x-2)^5} - \frac{6400}{9(x-2)^6}\Big)H(2,c_2(\alpha_0);x) + \Big(\frac{x\alpha_0^5}{2} + \frac{5\alpha_0^5}{6(x-2)} - \frac{\alpha_0^5}{3(x-1)} + \alpha_0^5 - \frac{19x\alpha_0^4}{6} - \frac{35\alpha_0^4}{18(x-2)} + \frac{13\alpha_0^4}{9(x-1)} + \frac{25\alpha_0^4}{9(x-2)^2} -$$

$$\frac{4\alpha_0^4}{9(x-1)^2} - \frac{14\alpha_0^4}{3} + \frac{26x\alpha_0^3}{3} - \frac{5\alpha_0^3}{9(x-2)} - \frac{22\alpha_0^3}{9(x-1)} - \frac{20\alpha_0^3}{9(x-2)^2} + \frac{14\alpha_0^3}{9(x-1)^2} + \frac{100\alpha_0^3}{9(x-2)^3} - \frac{2\alpha_0^3}{3(x-1)^3} + 8\alpha_0^3 - 14x\alpha_0^2 + \frac{5\alpha_0^2}{x-2} +$$

$$\frac{2\alpha_0^2}{x-1} - \frac{10\alpha_0^2}{(x-2)^2} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{20\alpha_0^2}{(x-2)^3} + \frac{2\alpha_0^2}{(x-1)^3} + \frac{200\alpha_0^2}{3(x-2)^4} - \frac{4\alpha_0^2}{3(x-1)^4} - 4\alpha_0^2 + \frac{73x\alpha_0}{6} - \frac{40\alpha_0}{9(x-2)} - \frac{73\alpha_0}{18(x-1)} + \frac{160\alpha_0}{9(x-2)^2} +$$

$$\frac{5\alpha_0}{18(x-1)^2} - \frac{80\alpha_0}{(x-2)^3} - \frac{11\alpha_0}{9(x-1)^3} - \frac{480\alpha_0}{(x-2)^4} - \frac{32\alpha_0}{9(x-1)^4} - \frac{800\alpha_0}{3(x-2)^5} + \frac{29\alpha_0}{9(x-1)^5} + \frac{11\alpha_0}{3} - \frac{25x}{6} + \Big(\frac{8\alpha_0}{3(x-1)^4} - \frac{8\alpha_0}{3(x-1)^5} -$$

$$\frac{8}{3(x-1)^4} - \frac{8}{3(x-1)^5}\Big)H(0;\alpha_0) + \Big(-\frac{4\alpha_0}{(x-1)^4} + \frac{4\alpha_0}{(x-1)^5} + \frac{4}{(x-1)^4} + \frac{4}{(x-1)^5}\Big)H(1;\alpha_0) + \frac{40}{9(x-2)} - \frac{71}{18(x-1)} -$$

$$\frac{80}{9(x-2)^2} - \frac{1}{6(x-1)^2} + \frac{400}{9(x-2)^3} + \frac{7}{9(x-1)^3} + \frac{1280}{3(x-2)^4} + \frac{38}{9(x-1)^4} + \frac{1600}{3(x-2)^5} + \frac{29}{9(x-1)^5} - 4\Big)H(c_1(\alpha_0),c_1(\alpha_0);x) +$$

$$\Big(-\frac{x\alpha_0^5}{6} - \frac{\alpha_0^5}{6(x-1)} + \frac{\alpha_0^5}{2} + \frac{19x\alpha_0^4}{18} + \frac{13\alpha_0^4}{18(x-1)} - \frac{2\alpha_0^4}{9(x-1)^2} - \frac{47\alpha_0^4}{18} - \frac{26x\alpha_0^3}{9} - \frac{11\alpha_0^3}{9(x-1)} + \frac{7\alpha_0^3}{9(x-1)^2} - \frac{\alpha_0^3}{3(x-1)^3} + \frac{17\alpha_0^3}{3} +$$

$$\frac{14x\alpha_0^2}{3} + \frac{\alpha_0^2}{x-1} - \frac{\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} - \frac{2\alpha_0^2}{3(x-1)^4} - 7\alpha_0^2 - \frac{73x\alpha_0}{18} + \frac{8\alpha_0}{9(x-2)} + \frac{\alpha_0}{18(x-1)} - \frac{8\alpha_0}{9(x-2)^2} + \frac{\alpha_0}{9(x-1)^2} + \frac{\alpha_0}{3(x-1)^3} -$$

$$\frac{320\alpha_0}{9(x-2)^4} - \frac{4\alpha_0}{3(x-1)^4} - \frac{640\alpha_0}{9(x-2)^5} + \frac{41\alpha_0}{18} + \frac{25x}{18} + \Big(\frac{832\alpha_0}{3(x-2)^4} + \frac{1280\alpha_0}{3(x-2)^5} - \frac{832}{3(x-2)^4} - \frac{2944}{3(x-2)^5} - \frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0) +$$

$$\Big(-\frac{416\alpha_0}{(x-2)^4} - \frac{640\alpha_0}{(x-2)^5} + \frac{416}{(x-2)^4} + \frac{1472}{(x-2)^5} + \frac{1280}{(x-2)^6}\Big)H(1;\alpha_0) + \frac{16}{9(x-2)} - \frac{7}{18(x-1)} - \frac{8}{9(x-2)^2} - \frac{5}{9(x-1)^2} +$$

$$\frac{16}{9(x-2)^3} - \frac{1}{(x-1)^3} + \frac{320}{9(x-2)^4} - \frac{2}{3(x-1)^4} + \frac{1280}{9(x-2)^5} + \frac{1280}{9(x-2)^6} + \frac{7}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{16x\alpha_0}{3} + \frac{1280\alpha_0}{3(x-2)^4} +$$

$$\frac{16\alpha_0}{3(x-1)^4} + \frac{2560\alpha_0}{3(x-2)^5} - \frac{16\alpha_0}{3(x-1)^5} - \frac{32\alpha_0}{3} - \frac{16x}{3} - \frac{1280}{3(x-2)^4} - \frac{16}{3(x-1)^4} - \frac{5120}{3(x-2)^5} - \frac{16}{3(x-1)^5} - \frac{5120}{3(x-2)^6}\Big)H(0,0,0;\alpha_0) +$$

$$\Big(\frac{16x\alpha_0}{3} - \frac{1280\alpha_0}{3(x-2)^4} - \frac{16\alpha_0}{3(x-1)^4} - \frac{2560\alpha_0}{3(x-2)^5} + \frac{16\alpha_0}{3(x-1)^5} - \frac{32\alpha_0}{3} - \frac{16x}{3} + \frac{1280}{3(x-2)^4} + \frac{16}{3(x-1)^4} + \frac{5120}{3(x-2)^5} + \frac{16}{3(x-1)^5} +$$

$$\frac{5120}{3(x-2)^6}\Big)H(0,0,0;x) + \Big(-8x\alpha_0 - \frac{640\alpha_0}{(x-2)^4} - \frac{8\alpha_0}{(x-1)^4} - \frac{1280\alpha_0}{(x-2)^5} + \frac{8\alpha_0}{(x-1)^5} + 16\alpha_0 + 8x + \frac{640}{(x-2)^4} + \frac{8}{(x-1)^4} +$$

$$\frac{2560}{(x-2)^5} + \frac{8}{(x-1)^5} + \frac{2560}{(x-2)^6}\Big)H(0,0,1;\alpha_0) + \Big(-\frac{8x\alpha_0}{3} - \frac{736\alpha_0}{3(x-2)^4} + \frac{8\alpha_0}{3(x-1)^4} - \frac{1280\alpha_0}{3(x-2)^5} - \frac{8\alpha_0}{3(x-1)^5} + \frac{16\alpha_0}{3} +$$

$$\frac{8x}{3} + \frac{736}{3(x-2)^4} - \frac{8}{3(x-1)^4} + \frac{2752}{3(x-2)^5} - \frac{8}{3(x-1)^5} + \frac{2560}{3(x-2)^6}\Big)H(0,0,c_1(\alpha_0);x) + \Big(\frac{1280\alpha_0}{3(x-2)^4} + \frac{2560\alpha_0}{3(x-2)^5} -$$

$$\frac{1280}{3(x-2)^4} - \frac{5120}{3(x-2)^5} - \frac{5120}{3(x-2)^6}\Big)H(0,0,c_2(\alpha_0);x) + \Big(-8x\alpha_0 - \frac{640\alpha_0}{(x-2)^4} - \frac{8\alpha_0}{(x-1)^4} - \frac{1280\alpha_0}{(x-2)^5} + \frac{8\alpha_0}{(x-1)^5} + 16\alpha_0 +$$

$$8x + \frac{640}{(x-2)^4} + \frac{8}{(x-1)^4} + \frac{2560}{(x-2)^5} + \frac{8}{(x-1)^5} + \frac{2560}{(x-2)^6}\Big)H(0,1,0;\alpha_0) + \Big(\frac{20x\alpha_0}{3} + \frac{1984\alpha_0}{3(x-2)^4} - \frac{20\alpha_0}{3(x-1)^4} +$$

$$\frac{3200\alpha_0}{3(x-2)^5} + \frac{20\alpha_0}{3(x-1)^5} - \frac{40\alpha_0}{3} - \frac{20x}{3} - \frac{1984}{3(x-2)^4} + \frac{20}{3(x-1)^4} - \frac{7168}{3(x-2)^5} + \frac{20}{3(x-1)^5} - \frac{6400}{3(x-2)^6}\Big)H(0,1,0;x) +$$

$$\Big(12x\alpha_0 + \frac{960\alpha_0}{(x-2)^4} + \frac{12\alpha_0}{(x-1)^4} + \frac{1920\alpha_0}{(x-2)^5} - \frac{12\alpha_0}{(x-1)^5} - 24\alpha_0 - 12x - \frac{960}{(x-2)^4} - \frac{12}{(x-1)^4} - \frac{3840}{(x-2)^5} - \frac{12}{(x-1)^5} -$$

$$\frac{3840}{}(x-2)^6\Big)H(0,1,1;\alpha_0) + \Big(-\frac{20x\alpha_0}{3} - \frac{1984\alpha_0}{3(x-2)^4} + \frac{20\alpha_0}{3(x-1)^4} - \frac{3200\alpha_0}{3(x-2)^5} - \frac{20\alpha_0}{3(x-1)^5} + \frac{40\alpha_0}{3} + \frac{20x}{3} + \frac{1984}{3(x-2)^4} -$$

$$\frac{20}{3(x-1)^4} + \frac{7168}{3(x-2)^5} - \frac{20}{3(x-1)^5} + \frac{6400}{3(x-2)^6}\Big)H(0,1,c_1(\alpha_0);x) + \Big(\frac{3200\alpha_0}{3(x-2)^4} + \frac{6400\alpha_0}{3(x-2)^5} - \frac{3200}{3(x-2)^4} - \frac{12800}{3(x-2)^5} -$$

$$\frac{12800}{3(x-2)^6}\Big)H(0,2,0;x) + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} + \frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big)H(0,2,c_2(\alpha_0);x) + \Big(-$$

$$2x\alpha_0 - \frac{640\alpha_0}{3(x-2)^4} + \frac{4\alpha_0}{3(x-1)^4} - \frac{800\alpha_0}{3(x-2)^5} - \frac{4\alpha_0}{3(x-1)^5} + 4\alpha_0 + 2x + \frac{640}{3(x-2)^4} - \frac{4}{3(x-1)^4} + \frac{2080}{3(x-2)^5} - \frac{4}{3(x-1)^5} +$$

$$\frac{1600}{3(x-2)^6}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{2x\alpha_0}{3} + \frac{832\alpha_0}{3(x-2)^4} - \frac{2\alpha_0}{3(x-1)^4} + \frac{1280\alpha_0}{3(x-2)^5} + \frac{2\alpha_0}{3(x-1)^5} - \frac{4\alpha_0}{3} - \frac{2x}{3} - \frac{832}{3(x-2)^4} +$$

$$\frac{2}{3(x-1)^4} - \frac{2944}{3(x-2)^5} + \frac{2}{3(x-1)^5} - \frac{2560}{3(x-2)^6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{8x\alpha_0}{3} + \frac{832\alpha_0}{3(x-2)^4} - \frac{32\alpha_0}{3(x-1)^4} + \frac{1280\alpha_0}{3(x-2)^5} +$$

$$\frac{32\alpha_0}{3(x-1)^5} - \frac{16\alpha_0}{3} - \frac{8x}{3} - \frac{832}{3(x-2)^4} + \frac{32}{3(x-1)^4} - \frac{2944}{3(x-2)^5} + \frac{32}{3(x-1)^5} - \frac{2560}{3(x-2)^6}\Big)H(1,0,0;x) + \Big(-\frac{2x\alpha_0}{3} - \frac{64\alpha_0}{(x-2)^4} +$$

$$\frac{16\alpha_0}{3(x-1)^4} - \frac{160\alpha_0}{(x-2)^5} - \frac{16\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} + \frac{2x}{3} + \frac{64}{(x-2)^4} - \frac{16}{3(x-1)^4} + \frac{288}{(x-2)^5} - \frac{16}{3(x-1)^5} + \frac{320}{(x-2)^6}\Big)H(1,0,c_1(\alpha_0);x) +$$

$$\Big(\frac{14x\alpha_0}{3} + \frac{480\alpha_0}{(x-2)^4} - \frac{64\alpha_0}{3(x-1)^4} + \frac{800\alpha_0}{(x-2)^5} + \frac{64\alpha_0}{3(x-1)^5} - \frac{28\alpha_0}{3} - \frac{14x}{3} - \frac{480}{(x-2)^4} + \frac{64}{3(x-1)^4} - \frac{1760}{(x-2)^5} + \frac{64}{3(x-1)^5} -$$

$$\frac{1600}{(x-2)^6}\Big)H(1,1,0;x) + \Big(-\frac{14x\alpha_0}{3} - \frac{480\alpha_0}{(x-2)^4} + \frac{64\alpha_0}{3(x-1)^4} - \frac{800\alpha_0}{(x-2)^5} - \frac{64\alpha_0}{3(x-1)^5} + \frac{28\alpha_0}{3} + \frac{14x}{3} + \frac{480}{(x-2)^4} - \frac{64}{3(x-1)^4} +$$

$$\frac{1760}{(x-2)^5} - \frac{64}{3(x-1)^5} + \frac{1600}{(x-2)^6}\Big) H(1,1,c_1(\alpha_0);x) + \Big(-2x\alpha_0 - \frac{640\alpha_0}{3(x-2)^4} + \frac{16\alpha_0}{3(x-1)^4} - \frac{800\alpha_0}{3(x-2)^5} - \frac{16\alpha_0}{3(x-1)^5} + 4\alpha_0 +$$

$$2x + \frac{640}{3(x-2)^4} - \frac{16}{3(x-1)^4} + \frac{2080}{3(x-2)^5} - \frac{16}{3(x-1)^5} + \frac{1600}{3(x-2)^6}\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{3200\alpha_0}{3(x-2)^4} + \frac{6400\alpha_0}{3(x-2)^5} -$$

$$\frac{3200}{3(x-2)^4} - \frac{12800}{3(x-2)^5} - \frac{12800}{3(x-2)^6}\Big)H(2,0,0;x) + \Big(\frac{2x\alpha_0}{3} + \frac{2080\alpha_0}{3(x-2)^4} - \frac{2\alpha_0}{3(x-1)^4} + \frac{3200\alpha_0}{3(x-2)^5} + \frac{2\alpha_0}{3(x-1)^5} - \frac{4\alpha_0}{3} - \frac{2x}{3} -$$

$$\frac{2080}{3(x-2)^4} + \frac{2}{3(x-1)^4} - \frac{7360}{3(x-2)^5} + \frac{2}{3(x-1)^5} - \frac{6400}{3(x-2)^6}\Big) H(2,0,c_1(\alpha_0);x) + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} +$$

$$\frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big)H(2,0,c_2(\alpha_0);x) + \Big(-\frac{2x\alpha_0}{3} - \frac{2080\alpha_0}{3(x-2)^4} + \frac{2\alpha_0}{3(x-1)^4} - \frac{3200\alpha_0}{3(x-2)^5} - \frac{2\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} +$$

$$\frac{2x}{3} + \frac{2080}{3(x-2)^4} - \frac{2}{3(x-1)^4} + \frac{7360}{3(x-2)^5} - \frac{2}{3(x-1)^5} + \frac{6400}{3(x-2)^6}\Big)H(2,1,0;x) + \Big(\frac{2x\alpha_0}{3} + \frac{2080\alpha_0}{3(x-2)^4} - \frac{2\alpha_0}{3(x-1)^4} +$$

$$\frac{3200\alpha_0}{3(x-2)^5} + \frac{2\alpha_0}{3(x-1)^5} - \frac{4\alpha_0}{3} - \frac{2x}{3} - \frac{2080}{3(x-2)^4} + \frac{2}{3(x-1)^4} - \frac{7360}{3(x-2)^5} + \frac{2}{3(x-1)^5} - \frac{6400}{3(x-2)^6}\Big) H(2,1,c_1(\alpha_0);x) +$$

$$\Big(-\frac{8000\alpha_0}{3(x-2)^4} - \frac{16000\alpha_0}{3(x-2)^5} + \frac{8000}{3(x-2)^4} + \frac{32000}{3(x-2)^5} + \frac{32000}{3(x-2)^6}\Big)H(2,2,0;x) + \Big(\frac{8000\alpha_0}{3(x-2)^4} + \frac{16000\alpha_0}{3(x-2)^5} - \frac{8000}{3(x-2)^4} -$$

$$\frac{32000}{3(x-2)^5} - \frac{32000}{3(x-2)^6}\Big) H(2,2,c_2(\alpha_0);x) + \Big(-\frac{2x\alpha_0}{3} - \frac{2080\alpha_0}{3(x-2)^4} + \frac{2\alpha_0}{3(x-1)^4} - \frac{3200\alpha_0}{3(x-2)^5} - \frac{2\alpha_0}{3(x-1)^5} + \frac{4\alpha_0}{3} +$$

$$\frac{2x}{3} + \frac{2080}{3(x-2)^4} - \frac{2}{3(x-1)^4} + \frac{7360}{3(x-2)^5} - \frac{2}{3(x-1)^5} + \frac{6400}{3(x-2)^6}\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{4\alpha_0}{3(x-1)^4} -$$

$$\frac{4\alpha_0}{3(x-1)^5} - \frac{4}{3(x-1)^4} - \frac{4}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{2\alpha_0}{3(x-1)^4} - \frac{2\alpha_0}{3(x-1)^5} - \frac{2}{3(x-1)^4} -$$

$$\frac{2}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x) + \Big(-\frac{32\alpha_0}{(x-2)^4} + \frac{32}{(x-2)^4} + \frac{64}{(x-2)^5}\Big) H(c_2(\alpha_0),0,c_1(\alpha_0);x) +$$

$$\Big(\frac{640\alpha_0}{3(x-2)^4} + \frac{800\alpha_0}{3(x-2)^5} - \frac{640}{3(x-2)^4} - \frac{2080}{3(x-2)^5} - \frac{1600}{3(x-2)^6}\Big) H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x) + H(2,0;x)\Big(-\frac{1600\alpha_0}{9(x-2)^4} -$$

$$\frac{3200\alpha_0}{9(x-2)^5} - \frac{3200\ln 2\,\alpha_0}{3(x-2)^4} - \frac{6400\ln 2\,\alpha_0}{3(x-2)^5} + \frac{1600}{9(x-2)^4} + \frac{6400}{9(x-2)^5} + \frac{6400}{9(x-2)^6} + \frac{3200\ln 2}{3(x-2)^4} + \frac{12800\ln 2}{3(x-2)^5} + \frac{12800\ln 2}{3(x-2)^6}\Big) +$$

$$H(0,2;x)\Big(-\frac{3200\ln 2\,\alpha_0}{3(x-2)^4} - \frac{6400\ln 2\,\alpha_0}{3(x-2)^5} + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} + \frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0) +$$

$$\frac{3200\ln 2}{3(x-2)^4} + \frac{12800\ln 2}{3(x-2)^5} + \frac{12800\ln 2}{3(x-2)^6}\Big) + H(0,0;x)\Big(-\frac{58x\alpha_0}{9} - \frac{128\alpha_0}{9(x-2)} + \frac{74\alpha_0}{3(x-1)} + \frac{32\alpha_0}{9(x-2)^2} - \frac{52\alpha_0}{9(x-1)^2} + \frac{64\alpha_0}{(x-2)^3} +$$

$$\frac{46\alpha_0}{9(x-1)^3} + \frac{4480\alpha_0}{9(x-2)^4} + \frac{31\alpha_0}{9(x-1)^4} + \frac{1280\alpha_0}{9(x-2)^5} - \frac{58\alpha_0}{9(x-1)^5} + \frac{1280\ln 2\,\alpha_0}{3(x-2)^4} + \frac{2560\ln 2\,\alpha_0}{3(x-2)^5} + \frac{71\alpha_0}{9} + \frac{58x}{9} - \frac{160}{9(x-2)} + \frac{52}{3(x-1)} +$$

$$\frac{224}{9(x-2)^2} - \frac{14}{9(x-1)^2} - \frac{640}{9(x-2)^3} - \frac{8}{9(x-1)^3} - \frac{5632}{9(x-2)^4} - \frac{85}{9(x-1)^4} - \frac{10240}{9(x-2)^5} - \frac{58}{9(x-1)^5} - \frac{2560}{9(x-2)^6} - \frac{1280\ln 2}{3(x-2)^4} -$$

$$\frac{5120\ln 2}{3(x-2)^5} - \frac{5120\ln 2}{3(x-2)^6} + 5\Big) + H(2,2;x)\Big(\frac{8000\ln 2\,\alpha_0}{3(x-2)^4} + \frac{16000\ln 2\,\alpha_0}{3(x-2)^5} + \Big(\frac{8000\alpha_0}{3(x-2)^4} + \frac{16000\alpha_0}{3(x-2)^5} - \frac{8000}{3(x-2)^4} - \frac{32000}{3(x-2)^5} -$$

$$\frac{32000}{3(x-2)^6}\Big) H(0;\alpha_0) - \frac{8000\ln 2}{3(x-2)^4} - \frac{32000\ln 2}{3(x-2)^5} - \frac{32000\ln 2}{3(x-2)^6}\Big) + H(0;x)\Big(\frac{1}{2}\pi^2 x\alpha_0 + \frac{1351x\alpha_0}{108} + \frac{284\alpha_0}{3(x-2)} - \frac{691\alpha_0}{6(x-1)} -$$

$$\frac{664\alpha_0}{9(x-2)^2} + \frac{131\alpha_0}{9(x-1)^2} - \frac{560\alpha_0}{3(x-2)^3} - \frac{101\alpha_0}{9(x-1)^3} + \frac{8\pi^2\alpha_0}{3(x-2)^4} - \frac{31040\alpha_0}{27(x-2)^4} - \frac{7\pi^2\alpha_0}{18(x-1)^4} - \frac{1181\alpha_0}{216(x-1)^4} - \frac{80\pi^2\alpha_0}{3(x-2)^5} - \frac{640\alpha_0}{27(x-2)^5} +$$

$$\frac{7\pi^2\alpha_0}{18(x-1)^5} + \frac{1351\alpha_0}{108(x-1)^5} - \frac{640\ln^2 2\,\alpha_0}{3(x-2)^4} - \frac{1280\ln^2 2\,\alpha_0}{3(x-2)^5} - \frac{640\ln 2\,\alpha_0}{9(x-2)^4} - \frac{1280\ln 2\,\alpha_0}{9(x-2)^5} - \pi^2\alpha_0 - \frac{2929\alpha_0}{216} - \frac{\pi^2 x}{2} - \frac{1351x}{108} +$$

$$\frac{92}{x-2} - \frac{1133}{12(x-1)} - \frac{1040}{9(x-2)^2} + \frac{223}{36(x-1)^2} + \frac{3008}{9(x-2)^3} + \frac{103}{36(x-1)^3} - \frac{8\pi^2}{3(x-2)^4} + \frac{41120}{27(x-2)^4} + \frac{7\pi^2}{18(x-1)^4} + \frac{4223}{216(x-1)^4} +$$

$$\frac{64\pi^2}{3(x-2)^5} + \frac{62720}{27(x-2)^5} + \frac{7\pi^2}{18(x-1)^5} + \frac{1351}{108(x-1)^5} + \frac{160\pi^2}{3(x-2)^6} + \frac{1280}{27(x-2)^6} + \frac{640\ln^2 2}{3(x-2)^4} + \frac{2560\ln^2 2}{3(x-2)^5} + \frac{2560\ln^2 2}{3(x-2)^6} +$$

$$\frac{640\ln 2}{9(x-2)^4} + \frac{2560\ln 2}{9(x-2)^5} + \frac{2560\ln 2}{9(x-2)^6} - \frac{275}{24}\Big) + H(2;x)\Big(-\frac{1}{6}\pi^2 x\alpha_0 + \frac{40\pi^2\alpha_0}{9(x-2)^4} + \frac{\pi^2\alpha_0}{6(x-1)^4} + \frac{800\pi^2\alpha_0}{9(x-2)^5} - \frac{\pi^2\alpha_0}{6(x-1)^5} +$$

$$\frac{1600\ln^2 2\,\alpha_0}{3(x-2)^4} + \frac{3200\ln^2 2\,\alpha_0}{3(x-2)^5} + \frac{1600\ln 2\,\alpha_0}{9(x-2)^4} + \frac{3200\ln 2\,\alpha_0}{9(x-2)^5} + \frac{\pi^2\alpha_0}{3} + \frac{\pi^2 x}{6} + \Big(\frac{1600\alpha_0}{9(x-2)^4} + \frac{3200\alpha_0}{9(x-2)^5} - \frac{1600}{9(x-2)^4} -$$

$$\frac{6400}{9(x-2)^5} - \frac{6400}{9(x-2)^6}\Big)H(0;\alpha_0) + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} + \frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big)H(0,0;\alpha_0) +$$

$$\Big(\frac{1600\alpha_0}{(x-2)^4} + \frac{3200\alpha_0}{(x-2)^5} - \frac{1600}{(x-2)^4} - \frac{6400}{(x-2)^5} - \frac{6400}{(x-2)^6}\Big)H(0,1;\alpha_0) - \frac{40\pi^2}{9(x-2)^4} - \frac{\pi^2}{6(x-1)^4} - \frac{880\pi^2}{9(x-2)^5} - \frac{\pi^2}{6(x-1)^5} -$$

$$\frac{1600\pi^2}{9(x-2)^6} - \frac{1600\ln^2 2}{3(x-2)^4} - \frac{6400\ln^2 2}{3(x-2)^5} - \frac{6400\ln^2 2}{3(x-2)^6} - \frac{1600\ln 2}{9(x-2)^4} - \frac{6400\ln 2}{9(x-2)^5} - \frac{6400\ln 2}{9(x-2)^6}\Big) - \frac{16\pi^2}{9(x-2)} + \frac{461\pi^2}{216(x-1)} + \frac{22\pi^2}{9(x-2)^2} -$$

$$\frac{23\pi^2}{54(x-1)^2} - \frac{4\pi^2}{(x-2)^3} - \frac{29\pi^2}{108(x-1)^3} - \frac{656\pi^2}{27(x-2)^4} - \frac{28\pi^2}{27(x-1)^4} - \frac{1760\pi^2}{27(x-2)^5} - \frac{29\pi^2}{54(x-1)^5} - \frac{320\pi^2}{27(x-2)^6} - \frac{17}{12}x\zeta_3 - \frac{224\zeta_3}{3(x-2)^4} +$$

$$\frac{7\zeta_3}{4(x-1)^4} - \frac{728\zeta_3}{3(x-2)^5} + \frac{7\zeta_3}{4(x-1)^5} - \frac{560\zeta_3}{3(x-2)^6} - \frac{640\ln^3 2}{9(x-2)^4} - \frac{2560\ln^3 2}{9(x-2)^5} - \frac{2560\ln^3 2}{9(x-2)^6} - \frac{320\ln^2 2}{9(x-2)^4} - \frac{1280\ln^2 2}{9(x-2)^5} - \frac{1280\ln^2 2}{9(x-2)^6} +$$

$$\frac{1}{6}\pi^2 x\ln 2 + \frac{32\pi^2\ln 2}{3(x-2)^4} - \frac{320\ln 2}{27(x-2)^4} - \frac{\pi^2\ln 2}{6(x-1)^4} - \frac{16\pi^2\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{27(x-2)^5} - \frac{\pi^2\ln 2}{6(x-1)^5} - \frac{160\pi^2\ln 2}{3(x-2)^6} - \frac{1280\ln 2}{27(x-2)^6} + \frac{11\pi^2}{24}\Big\}.$$

E.4 The $\mathcal{B}$ integral for $k=-1$ and $\delta=-1$

The ε expansion for this integral reads

$$
\begin{aligned}
\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,-1,-1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;-1,-1)\\
&= \frac{1}{\varepsilon^2}b_{-2}^{(-1,-1)}+\frac{1}{\varepsilon}b_{-1}^{(-1,-1)}+b_{0}^{(-1,-1)}+\varepsilon b_{1}^{(-1,-1)}+\varepsilon^2 b_{2}^{(-1,-1)}+\mathcal{O}\left(\varepsilon^3\right),
\end{aligned}
\tag{E.4}
$$

where

$$b_{-2}^{(-1,-1)}=\tfrac{1}{8},$$

$$b_{-1}^{(-1,-1)}=-\tfrac{1}{2}H(0;x),$$

$$
\begin{aligned}
b_{0}^{(-1,-1)} = {}& \tfrac{\alpha_0^3}{12(x-1)^2}-\tfrac{\alpha_0^3}{12}+\tfrac{\alpha_0^2}{24\ (x-1)}-\tfrac{5\alpha_0^2}{24(x-1)^2}+\tfrac{7\alpha_0^2}{24(x-1)^3}+\tfrac{13\ \alpha_0^2}{24}-\tfrac{\alpha_0}{3(x-1)}+\tfrac{\alpha_0}{6(x-1)^2}-\tfrac{\alpha_0}{3\ (x-1)^3}+\\
& \tfrac{13\alpha_0}{12(x-1)^4}-\tfrac{23\ \alpha_0}{12}+\bigg(\tfrac{25}{12}+\tfrac{3}{4(x-1)}-\tfrac{1}{6\ (x-1)^2}-\tfrac{1}{6(x-1)^3}+\tfrac{3}{4(x-1)^4}+\tfrac{25}{12\ (x-1)^5}\bigg)H(0;\alpha_0)+\bigg(-\tfrac{25}{12}-\tfrac{3}{4\ (x-1)}+\\
& \tfrac{1}{6(x-1)^2}+\tfrac{1}{6(x-1)^3}-\tfrac{3}{4\ (x-1)^4}-\tfrac{25}{12(x-1)^5}\bigg)\ H(0;x)+\bigg(\tfrac{1}{(x-1)^5}-1\bigg)H(0;\alpha_0)\ H(1;x)+\bigg(-\tfrac{\alpha_0^4}{4(x-1)}+\tfrac{\alpha_0^4}{4}+\\
& \tfrac{\alpha_0^3}{x-1}-\tfrac{\alpha_0^3}{3(x-1)^2}-\tfrac{4\alpha_0^3}{3}-\tfrac{3\alpha_0^2}{2\ (x-1)}+\tfrac{\alpha_0^2}{(x-1)^2}-\tfrac{\alpha_0^2}{2(x-1)^3}+3\ \alpha_0^2+\tfrac{\alpha_0}{x-1}-\tfrac{\alpha_0}{(x-1)^2}+\tfrac{\alpha_0}{(x-1)^3}-\tfrac{\alpha_0}{(x-1)^4}-4\alpha_0+\tfrac{3}{4(x-1)}-\\
& \tfrac{1}{6(x-1)^2}-\tfrac{1}{6\ (x-1)^3}+\tfrac{3}{4(x-1)^4}+\tfrac{25}{12(x-1)^5}+\tfrac{25}{12}\bigg)\ H(c_1(\alpha_0);x)+2H(0,0;x)+\bigg(\tfrac{1}{(x-1)^5}-1\bigg)\ H(0,c_1(\alpha_0);x)+\\
& \bigg(1-\tfrac{1}{(x-1)^5}\bigg)\ H(1,0;x)+\bigg(\tfrac{1}{(x-1)^5}-1\bigg)\ H(1,c_1(\alpha_0);x)-\tfrac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\tfrac{\pi^{\ 2}}{6(x-1)^5}+\tfrac{\pi^2}{8},
\end{aligned}
$$

$$
\begin{aligned}
b_{1}^{(-1,-1)} = {}& \tfrac{7d_1\alpha_0^3}{72}-\tfrac{7d_1\alpha_0^3}{72(x-1)^2}+\tfrac{7\ \alpha_0^3}{36(x-1)^2}-\tfrac{7\alpha_0^3}{36}-\tfrac{109d_1\ \alpha_0^2}{144}-\tfrac{13d_1\alpha_0^2}{144(x-1)}+\tfrac{7\alpha_0^2}{72\ (x-1)}+\tfrac{29d_1\alpha_0^2}{144(x-1)^2}-\tfrac{35\alpha_0^2}{72\ (x-1)^2}-\\
& \tfrac{67d_1\alpha_0^2}{144(x-1)^3}+\tfrac{85\alpha_0^2}{72\ (x-1)^3}+\tfrac{127\alpha_0^2}{72}+\tfrac{305d_1\alpha_0}{72}-\tfrac{2\alpha_0}{3\ (x-2)}+\tfrac{19d_1\alpha_0}{18(x-1)}-\tfrac{10\alpha_0}{9(x-1)}-\tfrac{d_1\ \alpha_0}{9(x-1)^2}+\tfrac{13\alpha_0}{18(x-1)^2}+\tfrac{d_1\alpha_0}{18(x-1)^3}-\\
& \tfrac{7\alpha_0}{9(x-1)^3}-\tfrac{217d_1\alpha_0}{72(x-1)^4}+\tfrac{149\ \alpha_0}{18(x-1)^4}-\tfrac{101\alpha_0}{9}+\bigg(-\tfrac{\alpha_0^3}{3\ (x-1)^2}+\tfrac{\alpha_0^3}{3}-\tfrac{\alpha_0^2}{6(x-1)}+\tfrac{5\alpha_0^2}{6\ (x-1)^2}-\tfrac{7\alpha_0^2}{6(x-1)^3}-\tfrac{13\alpha_0^2}{6}+\tfrac{4\alpha_0}{3\ (x-1)}-\\
& \tfrac{2\alpha_0}{3(x-1)^2}+\tfrac{4\alpha_0}{3(x-1)^3}-\tfrac{13\ \alpha_0}{3(x-1)^4}+\tfrac{23\alpha_0}{3}-\tfrac{205\ d_1}{72}+\tfrac{4}{x-2}-\tfrac{15d_1}{8(x-1)}-\tfrac{1}{2\ (x-1)}-\tfrac{8}{3(x-2)^2}+\tfrac{5d_1}{18(x-1)^2}-\tfrac{13}{18\ (x-1)^2}+\\
& \tfrac{5d_1}{18(x-1)^3}+\tfrac{5}{18(x-1)^3}-\tfrac{15\ d_1}{8(x-1)^4}+\tfrac{9}{(x-1)^4}-\tfrac{205d_1}{72\ (x-1)^5}+\tfrac{130}{9(x-1)^5}+\tfrac{155}{18}\bigg)\ H(0;\alpha_0)+\bigg(\tfrac{15d_1}{8(x-1)}-\tfrac{5d_1}{18(x-1)^2}-\\
& \tfrac{5\ d_1}{18(x-1)^3}+\tfrac{15d_1}{8(x-1)^4}+\tfrac{205d_1}{72(x-1)^5}+\tfrac{205d_1}{72}-\tfrac{4}{x-2}+\tfrac{1}{2(x-1)}+\tfrac{8}{3\ (x-2)^2}+\tfrac{13}{18(x-1)^2}-\tfrac{5}{18\ (x-1)^3}-\tfrac{9}{(x-1)^4}+\tfrac{2\pi^2}{3(x-1)^5}-\\
& \tfrac{130}{9\ (x-1)^5}-\tfrac{\pi^2}{2}-\tfrac{155}{18}\bigg)H(0;x)+\bigg(\tfrac{d_1\ \alpha_0^3}{6}-\tfrac{d_1\alpha_0^3}{6(x-1)^2}-\tfrac{13d_1\ \alpha_0^2}{12}-\tfrac{d_1\alpha_0^2}{12(x-1)}+\tfrac{5d_1\alpha_0^2}{12(x-1)^2}-\tfrac{7d_1\alpha_0^2}{12(x-1)^3}+\tfrac{23d_1\alpha_0}{6}+\\
& \tfrac{2d_1\ \alpha_0}{3(x-1)}-\tfrac{d_1\alpha_0}{3(x-1)^2}+\tfrac{2d_1\alpha_0}{3\ (x-1)^3}-\tfrac{13d_1\alpha_0}{6(x-1)^4}-\tfrac{35d_1}{12}-\tfrac{7\ d_1}{12(x-1)}+\tfrac{d_1}{12(x-1)^2}-\tfrac{d_1}{12(x-1)^3}+\tfrac{13\ d_1}{6(x-1)^4}\bigg)H(1;\alpha_0)+\bigg(\tfrac{\pi^2}{2}-\\
& \tfrac{\pi^2}{2\ (x-1)^5}\bigg)H(2;x)+\bigg(-\tfrac{d_1\alpha_0^4}{8}+\tfrac{d_1\alpha_0^4}{8\ (x-1)}-\tfrac{\alpha_0^4}{4(x-1)}+\tfrac{\alpha_0^4}{4}+\tfrac{13d_1\alpha_0^3}{18}-\tfrac{d_1\alpha_0^3}{2(x-1)}+\tfrac{4\alpha_0^3}{3(x-1)}+\tfrac{2d_1\ \alpha_0^3}{9(x-1)^2}-\tfrac{17\alpha_0^3}{18(x-1)^2}-\\
& \tfrac{29\ \alpha_0^3}{18}-\tfrac{23d_1\alpha_0^2}{12}+\tfrac{\alpha_0^2}{3(x-2)}+\tfrac{3d_1\ \alpha_0^2}{4(x-1)}-\tfrac{41\alpha_0^2}{12(x-1)}-\tfrac{2d_1\alpha_0^2}{3\ (x-1)^2}+\tfrac{13\alpha_0^2}{4(x-1)^2}+\tfrac{d_1\alpha_0^2}{2\ (x-1)^3}-\tfrac{11\alpha_0^2}{4(x-1)^3}+\tfrac{59\alpha_0^2}{12}+\tfrac{25d_1\ \alpha_0}{6}-\\
& \tfrac{2\alpha_0}{x-2}-\tfrac{d_1\alpha_0}{2(x-1)}+\tfrac{20\alpha_0}{3\ (x-1)}+\tfrac{4\alpha_0}{3(x-2)^2}+\tfrac{2d_1\alpha_0}{3(x-1)^2}-\tfrac{17\ \alpha_0}{3(x-1)^2}-\tfrac{d_1\alpha_0}{(x-1)^3}+\tfrac{6\alpha_0}{(x-1)^3}+\tfrac{2\ d_1\alpha_0}{(x-1)^4}-\tfrac{21\alpha_0}{2(x-1)^4}-\tfrac{73\alpha_0}{6}-\tfrac{205\ d_1}{72}+\\
& \bigg(\tfrac{\alpha_0^4}{x-1}-\alpha_0^4-\tfrac{4\alpha_0^3}{x-1}+\tfrac{4\ \alpha_0^3}{3(x-1)^2}+\tfrac{16\alpha_0^3}{3}+\tfrac{6\alpha_0^2}{x-1}-\tfrac{4\ \alpha_0^2}{(x-1)^2}+\tfrac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\tfrac{4\ \alpha_0}{x-1}+\tfrac{4\alpha_0}{(x-1)^2}-\tfrac{4\alpha_0}{(x-1)^3}+\tfrac{4\ \alpha_0}{(x-1)^4}+16\alpha_0-\\
& \tfrac{3}{x-1}+\tfrac{2}{3(x-1)^2}+\tfrac{2}{3\ (x-1)^3}-\tfrac{3}{(x-1)^4}-\tfrac{25}{3(x-1)^5}-\tfrac{25}{3}\bigg)\ H(0;\alpha_0)+\bigg(-\tfrac{d_1\alpha_0^4}{2}+\tfrac{d_1\alpha_0^4}{2(x-1)}+\tfrac{8\ d_1\alpha_0^3}{3}-\tfrac{2d_1\alpha_0^3}{x-1}+\tfrac{2d_1\alpha_0^3}{3(x-1)^2}-\\
& 6\ d_1\alpha_0^2+\tfrac{3d_1\alpha_0^2}{x-1}-\tfrac{2d_1\ \alpha_0^2}{(x-1)^2}+\tfrac{d_1\alpha_0^2}{(x-1)^3}+8d_1\alpha_0-\tfrac{2d_1\ \alpha_0}{x-1}+\tfrac{2d_1\alpha_0}{(x-1)^2}-\tfrac{2d_1\alpha_0}{(x-1)^3}+\tfrac{2\ d_1\alpha_0}{(x-1)^4}-\tfrac{25d_1}{6}-\tfrac{3d_1}{2(x-1)}+\tfrac{d_1}{3\ (x-1)^2}+\\
& \tfrac{d_1}{3(x-1)^3}-\tfrac{3d_1}{2(x-1)^4}-\tfrac{25\ d_1}{6(x-1)^5}\bigg)H(1;\alpha_0)+\tfrac{4}{x-2}-\tfrac{15d_1}{8\ (x-1)}-\tfrac{1}{2(x-1)}-\tfrac{8}{3(x-2)^2}+\tfrac{5d_1}{18\ (x-1)^2}-\tfrac{13}{18(x-1)^2}+\tfrac{5d_1}{18(x-1)^3}+\\
& \tfrac{5}{18\ (x-1)^3}-\tfrac{15d_1}{8(x-1)^4}+\tfrac{9}{(x-1)^4}-\tfrac{205d_1}{72\ (x-1)^5}+\tfrac{130}{9(x-1)^5}+\tfrac{155}{18}\bigg)\ H(c_1(\alpha_0);x)+\bigg(-\tfrac{25}{3}-\tfrac{3}{x-1}+\tfrac{2}{3\ (x-1)^2}+\\
& \tfrac{2}{3(x-1)^3}-\tfrac{3}{(x-1)^4}-\tfrac{25}{3\ (x-1)^5}\bigg)H(0,0;\alpha_0)+\bigg(\tfrac{25}{3}+\tfrac{3}{x-1}-\tfrac{2}{3\ (x-1)^2}-\tfrac{2}{3(x-1)^3}+\tfrac{3}{(x-1)^4}+\tfrac{25}{3\ (x-1)^5}\bigg)H(0,0;x)+
\end{aligned}
$$

$$\Big(-\frac{3d_1}{2(x-1)}+\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{3d_1}{2(x-1)^4}-\frac{25\ d_1}{6(x-1)^5}-\frac{25d_1}{6}\Big)H(0,1;\alpha_0)+H(1;x)\ \Big(-\frac{\pi^2 d_1}{3(x-1)^5}+\Big(\frac{2\ d_1}{x-1}-$$
$$\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-\frac{d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}-\frac{4}{x-2}+\frac{5}{2\ (x-1)}+\frac{8}{3(x-2)^2}-\frac{1}{3(x-1)^2}-\frac{8}{3\ (x-2)^3}+\frac{5}{3(x-1)^3}+\frac{3}{2(x-1)^4}+$$
$$\frac{25}{6\ (x-1)^5}-\frac{25}{6}\Big)H(0;\alpha_0)+\Big(4-\frac{4}{(x-1)^5}\Big)\ H(0,0;\alpha_0)+\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)H(0,1;\alpha_0)+\frac{\pi^{\ 2}}{3(x-1)^5}+\frac{\pi^2}{3}\Big)+$$
$$\Big(\frac{2d_1}{(x-1)^5}-2\ d_1-\frac{2}{(x-1)^5}+2\Big)H(0;\alpha_0)H(0,1;x)+\Big(-\frac{\alpha_0^4}{2\ (x-1)}+\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}-\frac{8\alpha_0^3}{3}-\frac{3\alpha_0^2}{x-1}+\frac{2\ \alpha_0^2}{(x-1)^2}-$$
$$\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2+\frac{2\ \alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-\frac{2\ \alpha_0}{(x-1)^4}-8\alpha_0+\Big(4-\frac{4}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(2\ d_1-\frac{2d_1}{(x-1)^5}\Big)\ H(1;\alpha_0)-$$
$$\frac{4}{x-2}+\frac{2}{x-1}+\frac{8}{3(x-2)^2}+\frac{1}{3\ (x-1)^2}-\frac{8}{3(x-2)^3}+\frac{2}{3(x-1)^3}+\frac{7}{2(x-1)^4}+\ \frac{25}{6(x-1)^5}\Big)H(0,c_1(\alpha_0);x)+\Big(-\frac{2\ d_1}{x-1}+$$
$$\frac{d_1}{(x-1)^2}-\frac{2d_1}{3(x-1)^3}+\frac{d_1}{2\ (x-1)^4}-\frac{25d_1}{6(x-1)^5}+\frac{4}{x-2}-\frac{5}{2\ (x-1)}-\frac{8}{3(x-2)^2}+\frac{1}{3(x-1)^2}+\frac{8}{3\ (x-2)^3}-\frac{5}{3(x-1)^3}-\frac{3}{2(x-1)^4}-$$
$$\frac{25}{6\ (x-1)^5}+\frac{25}{6}\Big)H(1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2d_1-\ \frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(1,1;x)+\Big(\frac{2\ d_1}{x-1}-\frac{d_1}{(x-1)^2}+\frac{2d_1}{3(x-1)^3}-$$
$$\frac{d_1}{2\ (x-1)^4}+\frac{25d_1}{6(x-1)^5}+\Big(4-\frac{4}{(x-1)^5}\Big)\ H(0;\alpha_0)+\Big(2d_1-\frac{2d_1}{(x-1)^5}\Big)\ H(1;\alpha_0)-\frac{4}{x-2}+\frac{5}{2(x-1)}+\frac{8}{3\ (x-2)^2}-$$
$$\frac{1}{3(x-1)^2}-\frac{8}{3(x-2)^3}+\frac{5}{3(x-1)^3}+\ \frac{3}{2(x-1)^4}+\frac{25}{6(x-1)^5}-\frac{25}{6}\Big)\ H(1,c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(2,1;x)+$$
$$\Big(\ \frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+\frac{2\ \alpha_0^3}{(x-1)^2}+8\alpha_0^3+\frac{9\alpha_0^2}{x-1}-\frac{6\ \alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-\frac{6\ \alpha_0}{x-1}+\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+\frac{6\ \alpha_0}{(x-1)^4}+$$
$$24\alpha_0+\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1\ \ H(1;\alpha_0)}{(x-1)^5}-\frac{9}{2\ (x-1)}+\frac{1}{(x-1)^2}+\frac{1}{(x-1)^3}-\frac{9}{2\ (x-1)^4}-\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)\ H(c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(-\frac{\alpha_0^4}{2\ (x-1)}+\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}-\ \frac{8\alpha_0^3}{3}-\frac{3\alpha_0^2}{x-1}+\frac{2\ \alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}+6\alpha_0^2+\frac{2\ \alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\alpha_0}{(x-1)^3}-\frac{2\ \alpha_0}{(x-1)^4}-$$
$$8\alpha_0+\frac{4}{x-2}-\frac{1}{2(x-1)}-\frac{8}{3\ (x-2)^2}-\frac{2}{3(x-1)^2}+\frac{8}{3\ (x-2)^3}-\frac{1}{(x-1)^3}-\frac{2}{(x-1)^4}+\frac{25}{6}\Big)H(c_2(\ \alpha_0),c_1(\alpha_0);x)-$$
$$8H(0,0,0;x)+\Big(2-\frac{2}{(x-1)^5}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(-\frac{2d_1}{(x-1)^5}+2\ d_1+\frac{2}{(x-1)^5}-2\Big)H(0,1,0;x)+$$
$$\Big(\frac{2d_1}{(x-1)^5}-2\ d_1-\frac{2}{(x-1)^5}+2\Big)\ H(0,1,c_1(\alpha_0);x)+\Big(6-\frac{2}{(x-1)^5}\Big)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2}{(x-1)^5}-$$
$$2\Big)\ H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4}{(x-1)^5}-4\Big)\ H(1,0,0;x)+\Big(\frac{2d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-2\Big)\ H(1,0,c_1(\alpha_0);x)+$$
$$\Big(-\frac{4d_1}{(x-1)^5}+2\ d_1+\frac{2}{(x-1)^5}+2\Big)H(1,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-2\ d_1-\frac{2}{(x-1)^5}-2\Big)H(1,1,c_1(\alpha_0);x)+\Big(-$$
$$\frac{2\ d_1}{(x-1)^5}-\frac{2}{(x-1)^5}+6\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\ \frac{2}{(x-1)^5}-2\Big)\ H(2,0,c_1(\alpha_0);x)+\Big(2-$$
$$\frac{2}{(x-1)^5}\Big)\ H(2,1,0;x)+\Big(\frac{2}{(x-1)^5}-2\Big)\ H(2,1,c_1(\alpha_0);x)+\Big(2-\frac{2}{(x-1)^5}\Big)\ H(2,c_2(\alpha_0),c_1(\alpha_0);x)-$$
$$\frac{2\ H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{6\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{2\ H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{\pi^2}{x-2}-\frac{3\ \pi^2}{8(x-1)}-\frac{2\pi^2}{3(x-2)^2}-$$
$$\frac{\pi^2}{9(x-1)^2}+\ \frac{2\pi^2}{3(x-2)^3}-\frac{7\pi^2}{36(x-1)^3}-\frac{3\pi^{\ 2}}{4(x-1)^4}-\frac{25\pi^2}{36(x-1)^5}-\frac{3\zeta_3}{4\ (x-1)^5}-4\zeta_3-\frac{\pi^2\ln 2}{2(x-1)^5}+\frac{1}{2}\pi^{\ 2}\ln 2+\frac{25\pi^2}{72},$$

$$b_2^{(-1,-1)}=-\frac{37}{432}d_1^2\alpha_0^3+\frac{37d_1\alpha_0^3}{108}+\frac{37d_1^2\ \alpha_0^3}{432(x-1)^2}-\frac{37d_1\alpha_0^3}{108(x-1)^2}-\frac{\pi^2\ \alpha_0^3}{72(x-1)^2}+\frac{37\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\ \alpha_0^3}{72}-\frac{37\alpha_0^3}{108}+$$
$$\frac{715d_1^2\alpha_0^2}{864}-\frac{104\ d_1\alpha_0^2}{27}+\frac{115d_1^2\alpha_0^2}{864(x-1)}-\frac{19d_1\ \alpha_0^2}{54(x-1)}-\frac{\pi^2\alpha_0^2}{144(x-1)}+\frac{37\alpha_0^2}{216\ (x-1)}-\frac{107d_1^2\alpha_0^2}{864(x-1)^2}+\frac{73d_1\alpha_0^2}{108\ (x-1)^2}+\frac{5\pi^2\alpha_0^2}{144(x-1)^2}-$$
$$\frac{185\alpha_0^2}{216\ (x-1)^2}+\frac{493d_1^2\alpha_0^2}{864(x-1)^3}-\frac{305d_1\alpha_0^2}{108\ (x-1)^3}-\frac{7\pi^2\alpha_0^2}{144(x-1)^3}+\frac{727\alpha_0^2}{216\ (x-1)^3}-\frac{13\pi^2\alpha_0^2}{144}+\frac{949\alpha_0^2}{216}-\frac{3515\ d_1^2\alpha_0}{432}+\frac{8965d_1\alpha_0}{216}+$$
$$\frac{25d_1\alpha_0}{9\ (x-2)}-\frac{50\alpha_0}{9(x-2)}-\frac{265d_1^2\alpha_0}{108\ (x-1)}+\frac{341d_1\alpha_0}{54(x-1)}+\frac{\pi^2\alpha_0}{18\ (x-1)}-\frac{107\alpha_0}{54(x-1)}-\frac{d_1^2\alpha_0}{108\ (x-1)^2}-\frac{185d_1\alpha_0}{108(x-1)^2}-\frac{\pi^2\alpha_0}{36\ (x-1)^2}+\frac{187\alpha_0}{54(x-1)^2}+$$
$$\frac{113d_1^2\alpha_0}{108\ (x-1)^3}-\frac{74d_1\alpha_0}{27(x-1)^3}+\frac{\pi^2\alpha_0}{18(x-1)^3}+\ \frac{25\alpha_0}{54(x-1)^3}+\frac{2911d_1^2\alpha_0}{432\ (x-1)^4}-\frac{7523d_1\alpha_0}{216(x-1)^4}-\frac{13\pi^2\alpha_0}{72\ (x-1)^4}+\frac{2369\alpha_0}{54(x-1)^4}+\frac{23\pi^2\ \alpha_0}{72}-$$
$$\frac{1394\alpha_0}{27}+\Big(-\frac{7d_1\alpha_0^3}{18}+\frac{7d_1\ \alpha_0^3}{18(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}+\frac{7\ \alpha_0^3}{9}+\frac{109d_1\alpha_0^2}{36}+\frac{13d_1\alpha_0^2}{36\ (x-1)}-\frac{7\alpha_0^2}{18(x-1)}-\frac{29d_1\alpha_0^2}{36\ (x-1)^2}+\frac{35\alpha_0^2}{18(x-1)^2}+$$
$$\frac{67d_1\alpha_0^2}{36(x-1)^3}-\frac{85\alpha_0^2}{18(x-1)^3}-\frac{127\alpha_0^2}{18}-\frac{305d_1\ \alpha_0}{18}+\frac{8\alpha_0}{3(x-2)}-\frac{38d_1\alpha_0}{9(x-1)}+\frac{40\ \alpha_0}{9(x-1)}+\frac{4d_1\alpha_0}{9(x-1)^2}-\frac{26\alpha_0}{9\ (x-1)^2}-\frac{2d_1\alpha_0}{9(x-1)^3}+\frac{28\alpha_0}{9\ (x-1)^3}+$$
$$\frac{217d_1\alpha_0}{18(x-1)^4}-\frac{298\alpha_0}{9\ (x-1)^4}+\frac{404\alpha_0}{9}+\frac{2035d_1^2}{432}-\frac{5615\ d_1}{216}-\frac{38d_1}{3(x-2)}+\frac{68}{3(x-2)}+\frac{63\ d_1^2}{16(x-1)}-\frac{85d_1}{24(x-1)}-\frac{\pi^2}{8\ (x-1)}-\frac{37}{4(x-1)}+$$
$$\frac{76d_1}{9(x-2)^2}-\frac{152}{9\ (x-2)^2}-\frac{19d_1^2}{54(x-1)^2}+\frac{317d_1}{108\ (x-1)^2}+\frac{\pi^2}{36(x-1)^2}+\frac{49}{108(x-1)^2}-\frac{19\ d_1^2}{54(x-1)^3}-\frac{313d_1}{108(x-1)^3}+\frac{\pi^2}{36\ (x-1)^3}+$$

$$\frac{949}{108(x-1)^3}+\frac{63d_1^2}{16\ (x-1)^4}-\frac{257d_1}{8(x-1)^4}-\frac{\pi^2}{8\ (x-1)^4}+\frac{213}{4(x-1)^4}+\frac{2035d_1^2}{432\ (x-1)^5}-\frac{8705d_1}{216(x-1)^5}-\frac{25\pi^2}{72\ (x-1)^5}+\frac{3965}{54(x-1)^5}-\frac{25\pi^2}{72}+$$

$$\left.\frac{940}{27}\right)H(0;\alpha_0)+\left(-\frac{7}{36}d_1^2\ \alpha_0^3+\frac{7d_1\alpha_0^3}{18}+\frac{7d_1^2\alpha_0^3}{36(x-1)^2}-\frac{7\ d_1\alpha_0^3}{18(x-1)^2}+\frac{109d_1^2\alpha_0^2}{72}-\frac{127d_1\ \alpha_0^2}{36}+\frac{13d_1^2\alpha_0^2}{72(x-1)}-\frac{7d_1\alpha_0^2}{36\ (x-1)}-\right.$$

$$\frac{29d_1^2\alpha_0^2}{72(x-1)^2}+\frac{35d_1\alpha_0^2}{36\ (x-1)^2}+\frac{67d_1^2\alpha_0^2}{72(x-1)^3}-\frac{85d_1\alpha_0^2}{36\ (x-1)^3}-\frac{305d_1^2\alpha_0}{36}+\frac{202d_1\alpha_0}{9}+\frac{4d_1\ \alpha_0}{3(x-2)}-\frac{19d_1^2\alpha_0}{9(x-1)}+\frac{20d_1\alpha_0}{9\ (x-1)}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-$$

$$\frac{13d_1\alpha_0}{9\ (x-1)^2}-\frac{d_1^2\alpha_0}{9(x-1)^3}+\frac{14d_1\alpha_0}{9\ (x-1)^3}+\frac{217d_1^2\alpha_0}{36(x-1)^4}-\frac{149d_1\alpha_0}{9\ (x-1)^4}+\frac{515d_1^2}{72}-\frac{695d_1}{36}-\frac{4d_1}{3\ (x-2)}+\frac{139d_1^2}{72(x-1)}-\frac{73d_1}{36\ (x-1)}-\frac{d_1^2}{72(x-1)^2}+$$

$$\left.\frac{31d_1}{36(x-1)^2}-\frac{59\ d_1^2}{72(x-1)^3}+\frac{29d_1}{36(x-1)^3}-\frac{217d_1^2}{36\ (x-1)^4}+\frac{149d_1}{9(x-1)^4}\right)H(1;\alpha_0)+\left(\frac{4\ \alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{2\alpha_0^2}{3(x-1)}-\frac{10\ \alpha_0^2}{3(x-1)^2}+\right.$$

$$\frac{14\alpha_0^2}{3(x-1)^3}+\frac{26\ \alpha_0^2}{3}-\frac{16\alpha_0}{3(x-1)}+\frac{8\alpha_0}{3(x-1)^2}-\frac{16\ \alpha_0}{3(x-1)^3}+\frac{52\alpha_0}{3(x-1)^4}-\frac{92\alpha_0}{3}+\frac{205\ d_1}{18}-\frac{16}{x-2}+\frac{15d_1}{2\ (x-1)}+\frac{2}{x-1}+\frac{32}{3(x-2)^2}-$$

$$\left.\frac{10d_1}{9\ (x-1)^2}+\frac{26}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}-\frac{10}{9\ (x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{36}{(x-1)^4}+\frac{205\ d_1}{18(x-1)^5}-\frac{520}{9(x-1)^5}-\frac{310}{9}\right)H(0,0;\alpha_0)+\ \left(-\right.$$

$$\frac{15d_1}{2(x-1)}+\frac{10d_1}{9(x-1)^2}+\frac{10d_1}{9\ (x-1)^3}-\frac{15d_1}{2(x-1)^4}-\frac{205d_1}{18\ (x-1)^5}-\frac{205d_1}{18}+\frac{16}{x-2}-\frac{2}{x-1}-\frac{32}{3\ (x-2)^2}-\frac{26}{9(x-1)^2}+\frac{10}{9\ (x-1)^3}+$$

$$\left.\frac{36}{(x-1)^4}-\frac{8\pi^2}{3(x-1)^5}+\frac{520}{9\ (x-1)^5}+2\pi^2+\frac{310}{9}\right)H(0,0;x)+\left(-\frac{2d_1\ \alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\ \alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3\ (x-1)^2}+\right.$$

$$\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8\ d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3\ (x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{205d_1^2}{36}-\frac{155\ d_1}{9}-\frac{8d_1}{x-2}+\frac{15d_1^2}{4\ (x-1)}+\frac{d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-$$

$$\left.\frac{5d_1^2}{9\ (x-1)^2}+\frac{13d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}-\frac{5\ d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{18\ d_1}{(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{260d_1}{9\ (x-1)^5}\right)H(0,1;\alpha_0)+\left(\frac{2\pi^2d_1}{3(x-1)^5}+\right.$$

$$\frac{2\ \pi^2d_1}{3}+\left(-\frac{8d_1}{x-2}+\frac{5d_1}{x-1}+\frac{16\ d_1}{3(x-2)^2}-\frac{2d_1}{3(x-1)^2}-\frac{16d_1}{3\ (x-2)^3}+\frac{10d_1}{3(x-1)^3}+\frac{3d_1}{(x-1)^4}+\frac{25\ d_1}{3(x-1)^5}-\frac{25d_1}{3}+\frac{8}{x-2}-\frac{16}{3\ (x-2)^2}-\right.$$

$$\left.\frac{8}{3(x-1)^2}+\frac{16}{3\ (x-2)^3}-\frac{8}{(x-1)^4}\right)H(0;\alpha_0)+\left(-\frac{8\ d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}-8\right)H(0,0;\alpha_0)+\left(-\frac{4\ d_1^2}{(x-1)^5}+4d_1^2+\right.$$

$$\left.\left.\frac{4d_1}{(x-1)^5}-4d_1\right)\ H(0,1;\alpha_0)-\frac{2\pi^2}{(x-1)^5}-\frac{2\pi^2}{3}\right)H(0,1;x)+\ \left(-\frac{\pi^2d_1}{(x-1)^5}+\pi^2d_1+\frac{\pi\ ^2}{(x-1)^5}-\pi^2\right)H(0,2;x)+\left(-\right.$$

$$\frac{2d_1\alpha_0^3}{3}+\frac{2\ d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3\ (x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3\ (x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\ \alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3\ (x-1)^4}+$$

$$\left.\frac{35d_1}{3}+\frac{7d_1}{3(x-1)}-\frac{d_1}{3\ (x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{26d_1}{3(x-1)^4}\right)\ H(1,0;\alpha_0)+\left(\frac{4d_1^2}{x-1}-\frac{d_1^2}{(x-1)^2}+\frac{4\ d_1^2}{9(x-1)^3}-\frac{d_1^2}{4(x-1)^4}+\frac{205d_1^2}{36\ (x-1)^5}-\right.$$

$$\frac{46d_1}{3(x-2)}-\frac{3d_1}{4(x-1)}+\frac{52d_1}{9\ (x-2)^2}+\frac{185d_1}{18(x-1)^2}-\frac{28d_1}{9(x-2)^3}-\frac{29\ d_1}{18(x-1)^3}+\frac{27d_1}{4(x-1)^4}+\frac{4\pi^2d_1}{3\ (x-1)^5}-\frac{835d_1}{36(x-1)^5}-\frac{205d_1}{36}+\frac{80}{3\ (x-2)}-$$

$$\left.\frac{70}{3(x-1)}-\frac{56}{9(x-2)^2}-\frac{13}{18(x-1)^2}+\ \frac{56}{9(x-2)^3}-\frac{355}{18(x-1)^3}-\frac{10}{3\ (x-1)^4}-\frac{7\pi^2}{6(x-1)^5}-\frac{155}{9(x-1)^5}-\frac{3\pi\ ^2}{2}+\frac{155}{9}\right)H(1,0;x)+$$

$$\left(-\frac{1}{3}d_1^2\ \alpha_0^3+\frac{d_1^2\alpha_0^3}{3(x-1)^2}+\frac{13d_1^2\ \alpha_0^2}{6}+\frac{d_1^2\alpha_0^2}{6(x-1)}-\frac{5d_1^2\alpha_0^2}{6\ (x-1)^2}+\frac{7d_1^2\alpha_0^2}{6(x-1)^3}-\frac{23d_1^2\ \alpha_0}{3}-\frac{4d_1^2\alpha_0}{3(x-1)}+\frac{2d_1^2\alpha_0}{3\ (x-1)^2}-\frac{4d_1^2\alpha_0}{3(x-1)^3}+\right.$$

$$\left.\frac{13d_1^2\alpha_0}{3\ (x-1)^4}+\frac{35d_1^2}{6}+\frac{7d_1^2}{6(x-1)}-\frac{d_1^2}{6\ (x-1)^2}+\frac{d_1^2}{6(x-1)^3}-\frac{13d_1^2}{3(x-1)^4}\right)\ H(1,1;\alpha_0)+H(0,c_1(\alpha_0);x)\left(-\frac{d_1\alpha_0^4}{4}+\frac{d_1\ \alpha_0^4}{4(x-1)}-\right.$$

$$\frac{\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{2}+\frac{13d_1\ \alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)}+\frac{4d_1\ \alpha_0^3}{9(x-1)^2}-\frac{14\alpha_0^3}{9(x-1)^2}-\frac{32\ \alpha_0^3}{9}-\frac{23d_1\alpha_0^2}{6}+\frac{2\alpha_0^2}{3(x-2)}+\frac{3d_1\ \alpha_0^2}{2(x-1)}-\frac{20\alpha_0^2}{3(x-1)}-$$

$$\frac{4d_1\alpha_0^2}{3\ (x-1)^2}+\frac{17\alpha_0^2}{3(x-1)^2}+\frac{d_1\ \alpha_0^2}{(x-1)^3}-\frac{13\alpha_0^2}{3(x-1)^3}+12\alpha_0^2+\frac{25d_1\ \alpha_0}{3}-\frac{4\alpha_0}{x-2}-\frac{d_1\alpha_0}{x-1}+\frac{12\ \alpha_0}{x-1}+\frac{8\alpha_0}{3(x-2)^2}+\frac{4d_1\alpha_0}{3\ (x-1)^2}-\frac{32\alpha_0}{3(x-1)^2}-$$

$$\frac{2d_1\alpha_0}{(x-1)^3}+\frac{32\ \alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{50\alpha_0}{3(x-1)^4}-32\ \alpha_0+\left(\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\ \alpha_0^3}{3(x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\ \alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}-\right.$$

$$24\alpha_0^2-\frac{8\ \alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\ \alpha_0}{(x-1)^4}+32\alpha_0+\frac{16}{x-2}-\frac{8}{x-1}-\frac{32}{3\ (x-2)^2}-\frac{4}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{8}{3\ (x-1)^3}-$$

$$\left.\frac{14}{(x-1)^4}-\frac{50}{3(x-1)^5}\right)\ H(0;\alpha_0)+\left(-d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}+\frac{16d_1\ \alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}-12\ d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\right.$$

$$\frac{2\ d_1\alpha_0^2}{(x-1)^3}+16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\ \alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\ \alpha_0}{(x-1)^4}+\frac{8d_1}{x-2}-\frac{4d_1}{x-1}-\frac{16d_1}{3\ (x-2)^2}-\frac{2d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{4\ d_1}{3(x-1)^3}-$$

$$\left.\frac{7d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}\right)\ H(1;\alpha_0)+\left(\frac{16}{(x-1)^5}-16\right)H(0,0;\alpha_0)+\left(\frac{8\ d_1}{(x-1)^5}-8d_1\right)H(0,1;\alpha_0)+\left(\frac{8d_1}{(x-1)^5}-\right.$$

$$\left.8\ d_1\right)H(1,0;\alpha_0)+\left(\frac{4d_1^2}{(x-1)^5}-4d_1^2\right)\ H(1,1;\alpha_0)+\frac{32d_1}{3(x-2)}-\frac{70}{3(x-2)}-\frac{20d_1}{3\ (x-1)}+\frac{95}{6(x-1)}-\frac{28d_1}{9(x-2)^2}+\frac{32}{9\ (x-2)^2}-$$

$$\frac{23d_1}{9(x-1)^2}+\frac{131}{18(x-1)^2}+\frac{28\ d_1}{9(x-2)^3}-\frac{56}{9(x-2)^3}-\frac{40d_1}{9\ (x-1)^3}+\frac{241}{18(x-1)^3}-\frac{31d_1}{4\ (x-1)^4}+\frac{20}{(x-1)^4}-\frac{205d_1}{36(x-1)^5}-\frac{\pi\ ^2}{6(x-1)^5}+$$

$$\left.\frac{155}{9(x-1)^5}+\frac{\pi\ ^2}{6}+\frac{35}{6}\right)+H(c_1(\alpha_0);x)\left(\frac{d_1^2\ \alpha_0^4}{16}-\frac{d_1\alpha_0^4}{4}-\frac{d_1^2\alpha_0^4}{16(x-1)}+\frac{d_1\ \alpha_0^4}{4(x-1)}+\frac{\pi^2\alpha_0^4}{24(x-1)}-\frac{\alpha_0^4}{4\ (x-1)}-\frac{\pi^2\alpha_0^4}{24}+\frac{\alpha_0^4}{4}-\right.$$

$$\frac{43d_1^2\ \alpha_0^3}{108}+\frac{193d_1\alpha_0^3}{108}+\frac{d_1^2\alpha_0^3}{4\ (x-1)}-\frac{25d_1\alpha_0^3}{18(x-1)}-\frac{\pi^2\alpha_0^3}{6\ (x-1)}+\frac{16\alpha_0^3}{9(x-1)}-\frac{4d_1^2\alpha_0^3}{27\ (x-1)^2}+\frac{127d_1\alpha_0^3}{108(x-1)^2}+\frac{\pi^2\alpha_0^3}{18\ (x-1)^2}-\frac{95\alpha_0^3}{54(x-1)^2}+$$

$$\frac{2\pi^2\ \alpha_0^3}{9}-\frac{107\alpha_0^3}{54}+\frac{95d_1^2\alpha_0^2}{72}-\frac{163\ d_1\alpha_0^2}{24}-\frac{13d_1\alpha_0^2}{18(x-2)}+\frac{13\alpha_0^2}{9\ (x-2)}-\frac{3d_1^2\alpha_0^2}{8(x-1)}+\frac{311d_1\alpha_0^2}{72\ (x-1)}+\frac{\pi^2\alpha_0^2}{4(x-1)}-\frac{281\alpha_0^2}{36\ (x-1)}+\frac{4d_1^2\alpha_0^2}{9(x-1)^2}-$$

$$\frac{295d_1\alpha_0^2}{72(x-1)^2}-\frac{\pi^2\alpha_0^2}{6(x-1)^2}+\frac{89\alpha_0^2}{12(x-1)^2}-\frac{d_1^2\alpha_0^2}{2(x-1)^3}+\frac{115d_1\alpha_0^2}{24(x-1)^3}+\frac{\pi^2\alpha_0^2}{12(x-1)^3}-\frac{35\alpha_0^2}{4(x-1)^3}-\frac{\pi^2\alpha_0^2}{2}+\frac{305\alpha_0^2}{36}-\frac{205d_1^2\alpha_0}{36}+$$

$$\frac{125d_1\alpha_0}{4}+\frac{17d_1\alpha_0}{3(x-2)}-\frac{10\alpha_0}{x-2}+\frac{d_1^2\alpha_0}{4(x-1)}-\frac{251d_1\alpha_0}{18(x-1)}-\frac{\pi^2\alpha_0}{6(x-1)}+\frac{1115\alpha_0}{36(x-1)}-\frac{38d_1\alpha_0}{9(x-2)^2}+\frac{76\alpha_0}{9(x-2)^2}-\frac{4d_1^2\alpha_0}{9(x-1)^2}+\frac{32d_1\alpha_0}{3(x-1)^2}+$$

$$\frac{\pi^2\alpha_0}{6(x-1)^2}-\frac{511\alpha_0}{18(x-1)^2}+\frac{d_1^2\alpha_0}{(x-1)^3}-\frac{31d_1\alpha_0}{3(x-1)^3}-\frac{\pi^2\alpha_0}{6(x-1)^3}+\frac{95\alpha_0}{4(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{409d_1\alpha_0}{12(x-1)^4}+\frac{\pi^2\alpha_0}{6(x-1)^4}-\frac{188\alpha_0}{3(x-1)^4}+$$

$$\frac{2\pi^2\alpha_0}{3}-\frac{374\alpha_0}{9}+\frac{2035d_1^2}{432}-\frac{5615d_1}{216}+\Bigg(\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2(x-1)}+\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{26d_1\alpha_0^3}{9}+\frac{2d_1\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)}-\frac{8d_1\alpha_0^3}{9(x-1)^2}+$$

$$\frac{34\alpha_0^3}{9(x-1)^2}+\frac{58\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}-\frac{4\alpha_0^2}{3(x-2)}-\frac{3d_1\alpha_0^2}{x-1}+\frac{41\alpha_0^2}{3(x-1)}+\frac{8d_1\alpha_0^2}{3(x-1)^2}-\frac{13\alpha_0^2}{(x-1)^2}-\frac{2d_1\alpha_0^2}{(x-1)^3}+\frac{11\alpha_0^2}{(x-1)^3}-\frac{59\alpha_0^2}{3}-\frac{50d_1\alpha_0}{3}+$$

$$\frac{8\alpha_0}{x-2}+\frac{2d_1\alpha_0}{x-1}-\frac{80\alpha_0}{3(x-1)}-\frac{16\alpha_0}{3(x-2)^2}-\frac{8d_1\alpha_0}{3(x-1)^2}+\frac{68\alpha_0}{3(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{24\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{42\alpha_0}{(x-1)^4}+\frac{146\alpha_0}{3}+\frac{205d_1}{18}-$$

$$\frac{16}{x-2}+\frac{15d_1}{2(x-1)}+\frac{2}{x-1}+\frac{32}{3(x-2)^2}-\frac{10d_1}{9(x-1)^2}+\frac{26}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}-\frac{10}{9(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{36}{(x-1)^4}+\frac{205d_1}{18(x-1)^5}-$$

$$\frac{520}{9(x-1)^5}-\frac{310}{9}\Bigg)H(0;\alpha_0)+\Bigg(\frac{d_1^2\alpha_0^4}{4}-\frac{d_1\alpha_0^4}{2}-\frac{d_1^2\alpha_0^4}{4(x-1)}+\frac{d_1\alpha_0^4}{2(x-1)}-\frac{13d_1^2\alpha_0^3}{9}+\frac{29d_1\alpha_0^3}{9}+\frac{d_1^2\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)}-\frac{4d_1^2\alpha_0^3}{9(x-1)^2}+$$

$$\frac{17d_1\alpha_0^3}{9(x-1)^2}+\frac{23d_1^2\alpha_0^2}{6}-\frac{59d_1\alpha_0^2}{6}-\frac{2d_1\alpha_0^2}{3(x-2)}-\frac{3d_1^2\alpha_0^2}{2(x-1)}+\frac{41d_1\alpha_0^2}{6(x-1)}+\frac{4d_1^2\alpha_0^2}{3(x-1)^2}-\frac{13d_1\alpha_0^2}{2(x-1)^2}-\frac{d_1^2\alpha_0^2}{(x-1)^3}+\frac{11d_1\alpha_0^2}{2(x-1)^3}-\frac{25d_1^2\alpha_0}{3}+$$

$$\frac{73d_1\alpha_0}{3}+\frac{4d_1\alpha_0}{x-2}+\frac{d_1^2\alpha_0}{x-1}-\frac{40d_1\alpha_0}{3(x-1)}-\frac{8d_1\alpha_0}{3(x-2)^2}-\frac{4d_1^2\alpha_0}{3(x-1)^2}+\frac{34d_1\alpha_0}{3(x-1)^2}+\frac{2d_1^2\alpha_0}{(x-1)^3}-\frac{12d_1\alpha_0}{(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{21d_1\alpha_0}{(x-1)^4}+$$

$$\frac{205d_1^2}{36}-\frac{155d_1}{9}-\frac{8d_1}{x-2}+\frac{15d_1^2}{4(x-1)}+\frac{d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-\frac{5d_1^2}{9(x-1)^2}+\frac{13d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}-\frac{5d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{18d_1}{(x-1)^4}+$$

$$\frac{205d_1^2}{36(x-1)^5}-\frac{260d_1}{9(x-1)^5}\Bigg)H(1;\alpha_0)+\Bigg(-\frac{4\alpha_0^4}{x-1}+4\alpha_0^4+\frac{16\alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)^2}-\frac{64\alpha_0^3}{3}-\frac{24\alpha_0^2}{x-1}+\frac{16\alpha_0^2}{(x-1)^2}-\frac{8\alpha_0^2}{(x-1)^3}+48\alpha_0^2+$$

$$\frac{16\alpha_0}{x-1}-\frac{16\alpha_0}{(x-1)^2}+\frac{16\alpha_0}{(x-1)^3}-\frac{16\alpha_0}{(x-1)^4}-64\alpha_0+\frac{12}{x-1}-\frac{8}{3(x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}+\frac{100}{3}\Bigg)H(0,0;\alpha_0)+$$

$$\Bigg(2d_1\alpha_0^4-\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-$$

$$\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Bigg)H(0,1;\alpha_0)+\Bigg(2d_1\alpha_0^4-$$

$$\frac{2d_1\alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-\frac{12d_1\alpha_0^2}{x-1}+\frac{8d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-1)^3}-$$

$$\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Bigg)H(1,0;\alpha_0)+\Bigg(d_1^2\alpha_0^4-\frac{d_1^2\alpha_0^4}{x-1}-\frac{16d_1^2\alpha_0^3}{3}+\frac{4d_1^2\alpha_0^3}{x-1}-$$

$$\frac{4d_1^2\alpha_0^3}{3(x-1)^2}+12d_1^2\alpha_0^2-\frac{6d_1^2\alpha_0^2}{x-1}+\frac{4d_1^2\alpha_0^2}{(x-1)^2}-\frac{2d_1^2\alpha_0^2}{(x-1)^3}-16d_1^2\alpha_0+\frac{4d_1^2\alpha_0}{x-1}-\frac{4d_1^2\alpha_0}{(x-1)^2}+\frac{4d_1^2\alpha_0}{(x-1)^3}-\frac{4d_1^2\alpha_0}{(x-1)^4}+\frac{25d_1^2}{3}+\frac{3d_1^2}{x-1}-$$

$$\frac{2d_1^2}{3(x-1)^2}-\frac{2d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}\Bigg)H(1,1;\alpha_0)-\frac{38d_1}{3(x-2)}+\frac{68}{3(x-2)}+\frac{63d_1^2}{16(x-1)}-\frac{85d_1}{24(x-1)}-\frac{\pi^2}{8(x-1)}-\frac{37}{4(x-1)}+$$

$$\frac{76d_1}{9(x-2)^2}-\frac{152}{9(x-2)^2}-\frac{19d_1^2}{54(x-1)^2}+\frac{317d_1}{108(x-1)^2}+\frac{\pi^2}{36(x-1)^2}+\frac{49}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}-\frac{313d_1}{108(x-1)^3}+\frac{\pi^2}{36(x-1)^3}+$$

$$\frac{949}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{257d_1}{8(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{213}{4(x-1)^4}+\frac{2035d_1^2}{432(x-1)^5}-\frac{8705d_1}{216(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+\frac{3965}{54(x-1)^5}-$$

$$\frac{25\pi^2}{72}+\frac{940}{27}\Bigg)+\Bigg(-\frac{2\pi^2d_1^2}{3(x-1)^5}+\frac{4\pi^2d_1}{3(x-1)^5}+\frac{2\pi^2d_1}{3}+\Bigg(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}-\frac{8d_1}{x-2}+\frac{9d_1}{x-1}+$$

$$\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{14d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}-\frac{25d_1}{3}-\frac{4}{x-2}-\frac{3}{2(x-1)}+\frac{8}{3(x-2)^2}-\frac{8}{3(x-2)^3}+$$

$$\frac{11}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{125}{6}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{16d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}+8\Bigg)H(0,0;\alpha_0)+\Bigg(-\frac{8d_1^2}{(x-1)^5}+$$

$$4d_1^2+\frac{4d_1}{(x-1)^5}+4d_1\Bigg)H(0,1;\alpha_0)-\frac{2\pi^2}{3(x-1)^5}-\frac{2\pi^2}{3}\Bigg)H(1,1;x)+\Bigg(-\frac{\pi^2d_1}{(x-1)^5}+\frac{\pi^2}{2(x-1)^5}+\frac{3\pi^2}{2}\Bigg)H(1,2;x)+\Bigg(-$$

$$\frac{4d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9(x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36(x-1)^5}+\frac{46d_1}{3(x-2)}+\frac{3d_1}{4(x-1)}-\frac{52d_1}{9(x-2)^2}-\frac{185d_1}{18(x-1)^2}+\frac{28d_1}{9(x-2)^3}+\frac{29d_1}{18(x-1)^3}-$$

$$\frac{27d_1}{4(x-1)^4}+\frac{835d_1}{36(x-1)^5}+\frac{205d_1}{36}+\Bigg(-\frac{8d_1}{x-1}+\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}+\frac{16}{x-2}-\frac{10}{x-1}-\frac{32}{3(x-2)^2}+$$

$$\frac{4}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{20}{3(x-1)^3}-\frac{6}{(x-1)^4}-\frac{50}{3(x-1)^5}+\frac{50}{3}\Bigg)H(0;\alpha_0)+\Bigg(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-$$

$$\frac{25d_1^2}{3(x-1)^5}+\frac{8d_1}{x-2}-\frac{5d_1}{x-1}-\frac{16d_1}{3(x-2)^2}+\frac{2d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{10d_1}{3(x-1)^3}-\frac{3d_1}{(x-1)^4}-\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{3}\Bigg)H(1;\alpha_0)+$$

$$\Bigg(\frac{16}{(x-1)^5}-16\Bigg)H(0,0;\alpha_0)+\Bigg(\frac{8d_1}{(x-1)^5}-8d_1\Bigg)H(0,1;\alpha_0)+\Bigg(\frac{8d_1}{(x-1)^5}-8d_1\Bigg)H(1,0;\alpha_0)+\Bigg(\frac{4d_1^2}{(x-1)^5}-$$

$$4d_1^2\Bigg)H(1,1;\alpha_0)-\frac{80}{3(x-2)}+\frac{70}{3(x-1)}+\frac{56}{9(x-2)^2}+\frac{13}{18(x-1)^2}-\frac{56}{9(x-2)^3}+\frac{355}{18(x-1)^3}+\frac{10}{3(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+$$

$$\frac{155}{9(x-1)^5}+\frac{\pi^2}{6}-\frac{155}{9}\Bigg)H(1,c_1(\alpha_0);x)+\Bigg(\frac{2\pi^2}{(x-1)^5}-2\pi^2\Bigg)H(2,0;x)+\Bigg(\Bigg(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-$$

$$\frac{8d_1}{(x-1)^4} - \frac{16}{x-2} + \frac{15}{2(x-1)} + \frac{32}{3(x-2)^2} + \frac{1}{3(x-1)^2} - \frac{32}{3(x-2)^3} + \frac{5}{(x-1)^3} + \frac{17}{2(x-1)^4} + \frac{25}{2(x-1)^5} - \frac{25}{2}\Bigr) H(0;\alpha_0) + \Bigl(8 -$$

$$\frac{8}{(x-1)^5}\Bigr) H(0,0;\alpha_0) + \Bigl(4d_1 - \frac{4d_1}{(x-1)^5}\Bigr) H(0,1;\alpha_0) - \frac{\pi^2}{3(x-1)^5} + \frac{\pi^2}{3}\Bigr) H(2,1;x) + \Bigl(\frac{\pi^2 d_1}{(x-1)^5} - \pi^2 d_1 - \frac{2\pi^2}{(x-1)^5} +$$

$$2\pi^2\Bigr) H(2,2;x) + \Bigl(\frac{3d_1\alpha_0^4}{4} - \frac{3d_1\alpha_0^4}{4(x-1)} + \frac{3\alpha_0^4}{2(x-1)} - \frac{3\alpha_0^4}{2} - \frac{13d_1\alpha_0^3}{3} + \frac{3d_1\alpha_0^3}{x-1} - \frac{49\alpha_0^3}{6(x-1)} - \frac{4d_1\alpha_0^3}{3(x-1)^2} + \frac{5\alpha_0^3}{(x-1)^2} + \frac{61\alpha_0^3}{6} +$$

$$\frac{23d_1\alpha_0^2}{2} - \frac{5\alpha_0^2}{3(x-2)} - \frac{9d_1\alpha_0^2}{2(x-1)} + \frac{83\alpha_0^2}{4(x-1)} + \frac{4d_1\alpha_0^2}{(x-1)^2} - \frac{109\alpha_0^2}{6(x-1)^2} - \frac{3d_1\alpha_0^2}{(x-1)^3} + \frac{85\alpha_0^2}{6(x-1)^3} - \frac{131\alpha_0^2}{4} - 25d_1\alpha_0 + \frac{10\alpha_0}{x-2} + \frac{3d_1\alpha_0}{x-1} -$$

$$\frac{229\alpha_0}{6(x-1)} - \frac{20\alpha_0}{3(x-2)^2} - \frac{4d_1\alpha_0}{(x-1)^2} + \frac{100\alpha_0}{3(x-1)^2} + \frac{6d_1\alpha_0}{(x-1)^3} - \frac{103\alpha_0}{3(x-1)^3} - \frac{12d_1\alpha_0}{(x-1)^4} + \frac{163\alpha_0}{3(x-1)^4} + \frac{169\alpha_0}{2} + \frac{205d_1}{12} + \Bigl(-\frac{6\alpha_0^4}{x-1} +$$

$$6\alpha_0^4 + \frac{24\alpha_0^3}{x-1} - \frac{8\alpha_0^3}{(x-1)^2} - 32\alpha_0^3 - \frac{36\alpha_0^2}{x-1} + \frac{24\alpha_0^2}{(x-1)^2} - \frac{12\alpha_0^2}{(x-1)^3} + 72\alpha_0^2 + \frac{24\alpha_0}{x-1} - \frac{24\alpha_0}{(x-1)^2} + \frac{24\alpha_0}{(x-1)^3} - \frac{24\alpha_0}{(x-1)^4} - 96\alpha_0 +$$

$$\frac{18}{x-1} - \frac{4}{(x-1)^2} - \frac{4}{(x-1)^3} + \frac{18}{(x-1)^4} + \frac{50}{(x-1)^5} + 50\Bigr) H(0;\alpha_0) + \Bigl(3d_1\alpha_0^4 - \frac{3d_1\alpha_0^4}{x-1} - 16d_1\alpha_0^3 + \frac{12d_1\alpha_0^3}{x-1} - \frac{4d_1\alpha_0^3}{(x-1)^2} +$$

$$36d_1\alpha_0^2 - \frac{18d_1\alpha_0^2}{x-1} + \frac{12d_1\alpha_0^2}{(x-1)^2} - \frac{6d_1\alpha_0^2}{(x-1)^3} - 48d_1\alpha_0 + \frac{12d_1\alpha_0}{x-1} - \frac{12d_1\alpha_0}{(x-1)^2} + \frac{12d_1\alpha_0}{(x-1)^3} - \frac{12d_1\alpha_0}{(x-1)^4} + 25d_1 + \frac{9d_1}{x-1} - \frac{2d_1}{(x-1)^2} -$$

$$\frac{2d_1}{(x-1)^3} + \frac{9d_1}{(x-1)^4} + \frac{25d_1}{(x-1)^5}\Bigr) H(1;\alpha_0) - \frac{16 H(0,0;\alpha_0)}{(x-1)^5} - \frac{8d_1 H(0,1;\alpha_0)}{(x-1)^5} - \frac{8d_1 H(1,0;\alpha_0)}{(x-1)^5} - \frac{4d_1^2 H(1,1;\alpha_0)}{(x-1)^5} - \frac{20}{x-2} +$$

$$\frac{45d_1}{4(x-1)} - \frac{31}{4(x-1)} + \frac{40}{3(x-2)^2} - \frac{5d_1}{3(x-1)^2} + \frac{55}{12(x-1)^2} - \frac{5d_1}{3(x-1)^3} - \frac{5}{4(x-1)^3} + \frac{45d_1}{4(x-1)^4} - \frac{83}{2(x-1)^4} + \frac{205d_1}{12(x-1)^5} +$$

$$\frac{\pi^2}{6(x-1)^5} - \frac{75}{(x-1)^5} - \frac{725}{12}\Bigr) H(c_1(\alpha_0),c_1(\alpha_0);x) + \Bigl(-\frac{d_1\alpha_0^4}{4} + \frac{d_1\alpha_0^4}{4(x-1)} - \frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} + \frac{13d_1\alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{3\alpha_0^3}{x-1} +$$

$$\frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{25\alpha_0^3}{18(x-1)^2} - \frac{61\alpha_0^3}{18} - \frac{23d_1\alpha_0^2}{6} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{31\alpha_0^2}{4(x-1)} - \frac{4d_1\alpha_0^2}{3(x-1)^2} + \frac{71\alpha_0^2}{12(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{15\alpha_0^2}{4(x-1)^3} + \frac{131\alpha_0^2}{12} +$$

$$\frac{25d_1\alpha_0}{3} - \frac{d_1\alpha_0}{x-1} + \frac{13\alpha_0}{x-1} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{35\alpha_0}{3(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{12\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{29\alpha_0}{2(x-1)^4} - \frac{169\alpha_0}{6} - \frac{205d_1}{36} + \Bigl(\frac{2\alpha_0^4}{x-1} -$$

$$2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} + \frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} - 24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} + 32\alpha_0 - \frac{16}{x-2} +$$

$$\frac{2}{x-1} + \frac{32}{3(x-2)^2} + \frac{8}{3(x-1)^2} - \frac{32}{3(x-2)^3} + \frac{4}{(x-1)^3} + \frac{8}{(x-1)^4} - \frac{50}{3}\Bigr) H(0;\alpha_0) + \Bigl(-d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} + \frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} +$$

$$\frac{4d_1\alpha_0^3}{3(x-1)^2} - 12d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} + 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{3} - \frac{8d_1}{x-2} +$$

$$\frac{d_1}{x-1} + \frac{16d_1}{3(x-2)^2} + \frac{4d_1}{3(x-1)^2} - \frac{16d_1}{3(x-2)^3} + \frac{2d_1}{(x-1)^3} + \frac{4d_1}{(x-1)^4}\Bigr) H(1;\alpha_0) - \frac{32d_1}{3(x-2)} + \frac{82}{3(x-2)} + \frac{35d_1}{12(x-1)} - \frac{73}{12(x-1)} +$$

$$\frac{28d_1}{9(x-2)^2} - \frac{56}{9(x-2)^2} + \frac{28d_1}{9(x-1)^2} - \frac{323}{36(x-1)^2} - \frac{28d_1}{9(x-2)^3} + \frac{56}{9(x-2)^3} + \frac{5d_1}{(x-1)^3} - \frac{53}{4(x-1)^3} + \frac{4d_1}{(x-1)^4} - \frac{29}{2(x-1)^4} +$$

$$\frac{725}{36}\Bigr) H(c_2(\alpha_0),c_1(\alpha_0);x) + \Bigl(\frac{100}{3} + \frac{12}{x-1} - \frac{8}{3(x-1)^2} - \frac{8}{3(x-1)^3} + \frac{12}{(x-1)^4} + \frac{100}{3(x-1)^5}\Bigr) H(0,0,0;\alpha_0) + \Bigl(-$$

$$\frac{100}{3} - \frac{12}{x-1} + \frac{8}{3(x-1)^2} + \frac{8}{3(x-1)^3} - \frac{12}{(x-1)^4} - \frac{100}{3(x-1)^5}\Bigr) H(0,0,0;x) + \Bigl(\frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} +$$

$$\frac{50d_1}{3(x-1)^5} + \frac{50d_1}{3}\Bigr) H(0,0,1;\alpha_0) + \Bigl(-\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{12}{(x-1)^5} - 12\Bigr) H(0;\alpha_0)\, H(0,0,1;x) + \Bigl(-\frac{\alpha_0^4}{x-1} + \alpha_0^4 +$$

$$\frac{4\alpha_0^3}{x-1} - \frac{4\alpha_0^3}{3(x-1)^2} - \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-1} + \frac{4\alpha_0^2}{(x-1)^2} - \frac{2\alpha_0^2}{(x-1)^3} + 12\alpha_0^2 + \frac{4\alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\alpha_0}{(x-1)^4} - 16\alpha_0 + \Bigl(\frac{8}{(x-1)^5} -$$

$$8\Bigr) H(0;\alpha_0) + \Bigl(\frac{4d_1}{(x-1)^5} - 4d_1\Bigr) H(1;\alpha_0) + \frac{8}{x-2} - \frac{1}{x-1} - \frac{16}{3(x-2)^2} - \frac{4}{3(x-1)^2} + \frac{16}{3(x-2)^3} - \frac{2}{(x-1)^3} - \frac{4}{(x-1)^4} +$$

$$\frac{25}{3}\Bigr) H(0,0,c_1(\alpha_0);x) + \Bigl(\frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5} + \frac{50d_1}{3}\Bigr) H(0,1,0;\alpha_0) + \Bigl(\frac{8d_1}{x-2} -$$

$$\frac{5d_1}{x-1} - \frac{16d_1}{3(x-2)^2} + \frac{2d_1}{3(x-1)^2} + \frac{16d_1}{3(x-2)^3} - \frac{10d_1}{3(x-1)^3} - \frac{3d_1}{(x-1)^4} - \frac{25d_1}{3(x-1)^5} + \frac{25d_1}{3} - \frac{8}{x-2} + \frac{16}{3(x-2)^2} + \frac{8}{3(x-1)^2} -$$

$$\frac{16}{3(x-2)^3} + \frac{8}{(x-1)^4}\Bigr) H(0,1,0;x) + \Bigl(\frac{3d_1^2}{x-1} - \frac{2d_1^2}{3(x-1)^2} - \frac{2d_1^2}{3(x-1)^3} + \frac{3d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} + \frac{25d_1^2}{3}\Bigr) H(0,1,1;\alpha_0) +$$

$$\Bigl(\frac{4d_1^2}{(x-1)^5} - 4d_1^2 - \frac{8d_1}{(x-1)^5} + \frac{12}{(x-1)^5} + 4\Bigr) H(0;\alpha_0)\, H(0,1,1;x) + \Bigl(-\frac{8d_1}{x-2} + \frac{5d_1}{x-1} + \frac{16d_1}{3(x-2)^2} - \frac{2d_1}{3(x-1)^2} -$$

$$\frac{16d_1}{3(x-2)^3} + \frac{10d_1}{3(x-1)^3} + \frac{3d_1}{(x-1)^4} + \frac{25d_1}{3(x-1)^5} - \frac{25d_1}{3} + \Bigl(-\frac{8d_1}{(x-1)^5} + 8d_1 + \frac{8}{(x-1)^5} - 8\Bigr) H(0;\alpha_0) + \Bigl(-\frac{4d_1^2}{(x-1)^5} + 4d_1^2 +$$

$$\frac{4d_1}{(x-1)^5} - 4d_1\Bigr) H(1;\alpha_0) + \frac{8}{x-2} - \frac{16}{3(x-2)^2} - \frac{8}{3(x-1)^2} + \frac{16}{3(x-2)^3} - \frac{8}{(x-1)^4}\Bigr) H(0,1,c_1(\alpha_0);x) + \Bigl(\frac{4d_1}{(x-1)^5} -$$

$$4d_1 - \frac{4}{(x-1)^5} + 4\Bigr) H(0;\alpha_0) H(0,2,1;x) + \Bigl(\frac{3\alpha_0^4}{x-1} - 3\alpha_0^4 - \frac{12\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{(x-1)^2} + 16\alpha_0^3 + \frac{18\alpha_0^2}{x-1} - \frac{12\alpha_0^2}{(x-1)^2} + \frac{6\alpha_0^2}{(x-1)^3} -$$

$$36\alpha_0^2 - \frac{12\alpha_0}{x-1} + \frac{12\alpha_0}{(x-1)^2} - \frac{12\alpha_0}{(x-1)^3} + \frac{12\alpha_0}{(x-1)^4} + 48\alpha_0 + \Bigl(\frac{8}{(x-1)^5} - 24\Bigr) H(0;\alpha_0) + \Bigl(\frac{4d_1}{(x-1)^5} - 12d_1\Bigr) H(1;\alpha_0) +$$

$$\frac{20}{x-2}-\frac{11}{2(x-1)}-\frac{40}{3(x-2)^2}-\frac{8}{3(x-1)^2}+\frac{40}{3(x-2)^3}-\frac{13}{3(x-1)^3}-\frac{13}{(x-1)^4}-\frac{25}{3(x-1)^5}+\frac{25}{2}\Big) H(0,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Big(-\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-1}-\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-$$
$$\frac{4\alpha_0}{(x-1)^4}-16\alpha_0+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{13}{2(x-1)}+\frac{32}{3(x-2)^2}+$$
$$\frac{5}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{3}{(x-1)^3}+\frac{25}{2(x-1)^4}+\frac{25}{2(x-1)^5}-\frac{25}{6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8d_1}{x-1}-\frac{4d_1}{(x-1)^2}+$$
$$\frac{8d_1}{3(x-1)^3}-\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}-\frac{16}{x-2}+\frac{10}{x-1}+\frac{32}{3(x-2)^2}-\frac{4}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{20}{3(x-1)^3}+\frac{6}{(x-1)^4}+\frac{50}{3(x-1)^5}-$$
$$\frac{50}{3}\Big)H(1,0,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{8d_1}{(x-1)^5}-4d_1+\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)\,H(1,0,1;x)+\Big(\frac{4d_1}{x-1}-\frac{2d_1}{(x-1)^2}+\frac{4d_1}{3(x-1)^3}-$$
$$\frac{d_1}{(x-1)^4}+\frac{25d_1}{3(x-1)^5}+\Big(-\frac{8d_1}{(x-1)^5}+\frac{8}{(x-1)^5}+8\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}+4d_1\Big)H(1;\alpha_0)-\frac{4}{x-2}-$$
$$\frac{3}{2(x-1)}+\frac{8}{3(x-2)^2}-\frac{8}{3(x-2)^3}+\frac{11}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{125}{6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-$$
$$\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}+\frac{8d_1}{x-2}-\frac{9d_1}{x-1}-\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{14d_1}{3(x-1)^3}-\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}+$$
$$\frac{25d_1}{3}+\frac{4}{x-2}+\frac{3}{2(x-1)}-\frac{8}{3(x-2)^2}+\frac{8}{3(x-2)^3}-\frac{11}{3(x-1)^3}+\frac{5}{(x-1)^4}+\frac{25}{3(x-1)^5}+\frac{125}{6}\Big)H(1,1,0;x)+\Big(\frac{12d_1^2}{(x-1)^5}-$$
$$4d_1^2-\frac{12d_1}{(x-1)^5}-8d_1+\frac{4}{(x-1)^5}+4\Big)H(0;\alpha_0)\,H(1,1,1;x)+\Big(\frac{4d_1^2}{x-1}-\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}-$$
$$\frac{8d_1}{x-2}+\frac{9d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{14d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}-\frac{25d_1}{3}+\Big(-\frac{16d_1}{(x-1)^5}+8d_1+$$
$$\frac{8}{(x-1)^5}+8\Big)H(0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{4d_1}{(x-1)^5}+4d_1\Big)H(1;\alpha_0)-\frac{4}{x-2}-\frac{3}{2(x-1)}+\frac{8}{3(x-2)^2}-\frac{8}{3(x-2)^3}+$$
$$\frac{11}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{125}{6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Big)H(0;\alpha_0)H(1,2,1;x)+$$
$$\Big(-\frac{12d_1}{x-1}+\frac{6d_1}{(x-1)^2}-\frac{4d_1}{(x-1)^3}+\frac{3d_1}{(x-1)^4}-\frac{25d_1}{(x-1)^5}+\Big(\frac{8d_1}{(x-1)^5}+\frac{8}{(x-1)^5}-24\Big)H(0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}+\frac{4d_1}{(x-1)^5}-$$
$$12d_1\Big)H(1;\alpha_0)+\frac{20}{x-2}-\frac{17}{2(x-1)}-\frac{40}{3(x-2)^2}+\frac{4}{3(x-1)^2}+\frac{40}{3(x-2)^3}-\frac{31}{3(x-1)^3}-\frac{1}{(x-1)^4}-\frac{25}{3(x-1)^5}+$$
$$\frac{75}{2}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4d_1-\frac{4}{(x-1)^5}+4\Big)H(0;\alpha_0)H(2,0,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-$$
$$\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{15}{2(x-1)}+$$
$$\frac{32}{3(x-2)^2}+\frac{1}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{5}{(x-1)^3}+\frac{17}{2(x-1)^4}+\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(2,0,c_1(\alpha_0);x)+\Big(-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+$$
$$\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\frac{16}{x-2}-\frac{15}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{1}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-\frac{25}{2(x-1)^5}+$$
$$\frac{25}{2}\Big)H(2,1,0;x)+\Big(\frac{4d_1}{(x-1)^5}-4d_1+\frac{2}{(x-1)^5}-2\Big)H(0;\alpha_0)H(2,1,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+$$
$$\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{15}{2(x-1)}+\frac{32}{3(x-2)^2}+$$
$$\frac{1}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{5}{(x-1)^3}+\frac{17}{2(x-1)^4}+\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(2,1,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+4d_1+\frac{8}{(x-1)^5}-$$
$$8\Big)H(0;\alpha_0)H(2,2,1;x)+\Big(-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\Big(\frac{8}{(x-1)^5}-8\Big)H(0;\alpha_0)+$$
$$\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{16}{x-2}-\frac{15}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{1}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-\frac{25}{2(x-1)^5}+$$
$$\frac{25}{2}\Big)H(2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}-24\alpha_0^2-$$
$$\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}+32\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\,H(1;\alpha_0)}{(x-1)^5}-\frac{6}{x-1}+\frac{4}{3(x-1)^2}+\frac{4}{3(x-1)^3}-\frac{6}{(x-1)^4}-$$
$$\frac{50}{3(x-1)^5}-\frac{50}{3}\Big)H(c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(-\frac{7\alpha_0^4}{x-1}+7\alpha_0^4+\frac{28\alpha_0^3}{x-1}-\frac{28\alpha_0^3}{3(x-1)^2}-\frac{112\alpha_0^3}{3}-\frac{42\alpha_0^2}{x-1}+\frac{28\alpha_0^2}{(x-1)^2}-$$
$$\frac{14\alpha_0^2}{(x-1)^3}+84\alpha_0^2+\frac{28\alpha_0}{x-1}-\frac{28\alpha_0}{(x-1)^2}+\frac{28\alpha_0}{(x-1)^3}-\frac{28\alpha_0}{(x-1)^4}-112\alpha_0-\frac{24\,H(0;\alpha_0)}{(x-1)^5}-\frac{12d_1\,H(1;\alpha_0)}{(x-1)^5}+\frac{21}{x-1}-$$
$$\frac{14}{3(x-1)^2}-\frac{14}{3(x-1)^3}+\frac{21}{(x-1)^4}+\frac{175}{3(x-1)^5}+\frac{175}{3}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3\alpha_0^4}{2(x-1)}-\frac{3\alpha_0^4}{2}-\frac{6\alpha_0^3}{x-1}+$$
$$\frac{2\alpha_0^3}{(x-1)^2}+8\alpha_0^3+\frac{9\alpha_0^2}{x-1}-\frac{6\alpha_0^2}{(x-1)^2}+\frac{3\alpha_0^2}{(x-1)^3}-18\alpha_0^2-\frac{6\alpha_0}{x-1}+\frac{6\alpha_0}{(x-1)^2}-\frac{6\alpha_0}{(x-1)^3}+\frac{6\alpha_0}{(x-1)^4}+24\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+$$

$\frac{4d_1\ H(1;\alpha_0)}{(x-1)^5} - \frac{9}{2\ (x-1)} + \frac{1}{(x-1)^2} + \frac{1}{(x-1)^3} - \frac{9}{2\ (x-1)^4} - \frac{25}{2(x-1)^5} - \frac{25}{2}\Big)\ H(c_1(\alpha_0), c_2(\alpha_0), c_1(\alpha_0); x) + \Big(- \frac{\alpha_0^4}{x-1} + \alpha_0^4 + \frac{4\ \alpha_0^3}{x-1} - \frac{4\alpha_0^3}{3(x-1)^2} - \frac{16\alpha_0^3}{3} - \frac{6\ \alpha_0^2}{x-1} + \frac{4\alpha_0^2}{(x-1)^2} - \frac{2\alpha_0^2}{(x-1)^3} + 12\alpha_0^2 + \frac{4\alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\ \alpha_0}{(x-1)^4} - 16\alpha_0 + \frac{8}{x-2} - \frac{1}{x-1} - \frac{16}{3\ (x-2)^2} - \frac{4}{3(x-1)^2} + \frac{16}{3\ (x-2)^3} - \frac{2}{(x-1)^3} - \frac{4}{(x-1)^4} + \frac{25}{3}\Big) H(c_2(\ \alpha_0), 0, c_1(\alpha_0); x) + \Big(\frac{5\alpha_0^4}{2(x-1)} - \frac{5\ \alpha_0^4}{2} - \frac{10\alpha_0^3}{x-1} + \frac{10\alpha_0^3}{3(x-1)^2} + \frac{40\ \alpha_0^3}{3} + \frac{15\alpha_0^2}{x-1} - \frac{10\alpha_0^2}{(x-1)^2} + \frac{5\ \alpha_0^2}{(x-1)^3} - 30\alpha_0^2 - \frac{10\alpha_0}{x-1} + \frac{10\ \alpha_0}{(x-1)^2} - \frac{10\alpha_0}{(x-1)^3} + \frac{10\alpha_0}{(x-1)^4} + 40\ \alpha_0 - \frac{20}{x-2} + \frac{5}{2(x-1)} + \frac{40}{3(x-2)^2} + \frac{10}{3\ (x-1)^2} - \frac{40}{3\ (x-2)^3} + \frac{5}{(x-1)^3} + \frac{10}{(x-1)^4} - \frac{125}{6}\Big)\ H(c_2(\alpha_0), c_1(\alpha_0), c_1(\alpha_0); x) + 32\ H(0,0,0,0; x) + \Big(\frac{12}{(x-1)^5} - 12\Big)\ H(0,0,0,c_1(\alpha_0); x) + \Big(\frac{4d_1}{(x-1)^5} - 4\ d_1 - \frac{12}{(x-1)^5} + 12\Big) H(0,0,1,0; x) + \Big(- \frac{4\ d_1}{(x-1)^5} + 4d_1 + \frac{12}{(x-1)^5} - 12\Big)\ H(0,0,1,c_1(\alpha_0); x) + \Big(- 12 - \frac{4}{(x-1)^5}\Big)\ H(0,0,c_1(\alpha_0), c_1(\alpha_0); x) + \Big(4 - \frac{4}{(x-1)^5}\Big)\ H(0,0,c_2(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{8d_1}{(x-1)^5} - 8\ d_1 - \frac{8}{(x-1)^5} + 8\Big) H(0,1,0,0; x) + \Big(- \frac{4\ d_1}{(x-1)^5} - 4d_1 + \frac{12}{(x-1)^5} + 4\Big)\ H(0,1,0,c_1(\alpha_0); x) + \Big(- \frac{4d_1^2}{(x-1)^5} + 4d_1^2 + \frac{8\ d_1}{(x-1)^5} - \frac{12}{(x-1)^5} - 4\Big) H(0,1,1,0; x) + \Big(\frac{4\ d_1^2}{(x-1)^5} - 4d_1^2 - \frac{8\ d_1}{(x-1)^5} + \frac{12}{(x-1)^5} + 4\Big)\ H(0,1,1,c_1(\alpha_0); x) + \Big(- \frac{4d_1}{(x-1)^5} + 12\ d_1 - \frac{4}{(x-1)^5} - 12\Big) H(0,1,c_1(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{4\ d_1}{(x-1)^5} - 4d_1 - \frac{4}{(x-1)^5} + 4\Big)\ H(0,2,0,c_1(\alpha_0); x) + \Big(- \frac{4d_1}{(x-1)^5} + 4\ d_1 + \frac{4}{(x-1)^5} - 4\Big) H(0,2,1,0; x) + \Big(\frac{4\ d_1}{(x-1)^5} - 4d_1 - \frac{4}{(x-1)^5} + 4\Big)\ H(0,2,1,c_1(\alpha_0); x) + \Big(- \frac{4d_1}{(x-1)^5} + 4\ d_1 + \frac{4}{(x-1)^5} - 4\Big) H(0,2,c_2(\alpha_0), c_1(\alpha_0); x) + 8\ H(0,c_1(\alpha_0), 0, c_1(\alpha_0); x) + \Big(\frac{4}{(x-1)^5} - 28\Big)\ H(0,c_1(\alpha_0), c_1(\alpha_0), c_1(\alpha_0); x) + \Big(6 + \frac{2}{(x-1)^5}\Big)\ H(0,c_1(\alpha_0), c_2(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{4}{(x-1)^5} - 4\Big)\ H(0,c_2(\alpha_0), 0, c_1(\alpha_0); x) + \Big(10 - \frac{10}{(x-1)^5}\Big)\ H(0,c_2(\alpha_0), c_1(\alpha_0), c_1(\alpha_0); x) + \Big(16 - \frac{16}{(x-1)^5}\Big)\ H(1,0,0,0; x) + \Big(\frac{8}{(x-1)^5} - \frac{4d_1}{(x-1)^5}\Big)\ H(1,0,0,c_1(\alpha_0); x) + \Big(- \frac{4d_1^2}{(x-1)^5} + \frac{8\ d_1}{(x-1)^5} + 4d_1 - \frac{8}{(x-1)^5}\Big) H(1,0,1,0; x) + \Big(\frac{4\ d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} - 4d_1 + \frac{8}{(x-1)^5}\Big)\ H(1,0,1,c_1(\alpha_0); x) + \Big(- \frac{4\ d_1}{(x-1)^5} + \frac{4}{(x-1)^5} + 4\Big)\ H(1,0,c_1(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{4\ d_1}{(x-1)^5} - \frac{2}{(x-1)^5} - 6\Big)\ H(1,0,c_2(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{16d_1}{(x-1)^5} - 8\ d_1 - \frac{8}{(x-1)^5} - 8\Big) H(1,1,0,0; x) + \Big(\frac{4\ d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} - 4d_1 + \frac{4}{(x-1)^5} + 4\Big)\ H(1,1,0,c_1(\alpha_0); x) + \Big(- \frac{12d_1^2}{(x-1)^5} + 4d_1^2 + \frac{12\ d_1}{(x-1)^5} + 8d_1 - \frac{4}{(x-1)^5} - 4\Big)\ H(1,1,1,0; x) + \Big(\frac{12d_1^2}{(x-1)^5} - 4d_1^2 - \frac{12\ d_1}{(x-1)^5} - 8d_1 + \frac{4}{(x-1)^5} + 4\Big)\ H(1,1,1,c_1(\alpha_0); x) + \Big(- \frac{4d_1^2}{(x-1)^5} - \frac{8\ d_1}{(x-1)^5} + 12d_1 + \frac{4}{(x-1)^5} + 4\Big)\ H(1,1,c_1(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{4\ d_1}{(x-1)^5} - \frac{2}{(x-1)^5} - 6\Big)\ H(1,2,0,c_1(\alpha_0); x) + \Big(- \frac{4\ d_1}{(x-1)^5} + \frac{2}{(x-1)^5} + 6\Big) H(1,2,1,0; x) + \Big(\frac{4\ d_1}{(x-1)^5} - \frac{2}{(x-1)^5} - 6\Big)\ H(1,2,1,c_1(\alpha_0); x) + \Big(- \frac{4\ d_1}{(x-1)^5} + \frac{2}{(x-1)^5} + 6\Big)\ H(1,2,c_2(\alpha_0), c_1(\alpha_0); x) + \Big(8 - \frac{4d_1}{(x-1)^5}\Big) H(1,c_1(\ \alpha_0), 0, c_1(\alpha_0); x) + \Big(\frac{12\ d_1}{(x-1)^5} + \frac{4}{(x-1)^5} - 28\Big)\ H(1,c_1(\alpha_0), c_1(\alpha_0), c_1(\alpha_0); x) + \Big(- \frac{4\ d_1}{(x-1)^5} + \frac{2}{(x-1)^5} + 6\Big)\ H(1,c_1(\alpha_0), c_2(\alpha_0), c_1(\alpha_0); x) + \Big(4 - \frac{4}{(x-1)^5}\Big)\ H(2,0,0,c_1(\alpha_0); x) + \Big(- \frac{4d_1}{(x-1)^5} + 4\ d_1 + \frac{4}{(x-1)^5} - 4\Big) H(2,0,1,0; x) + \Big(\frac{4\ d_1}{(x-1)^5} - 4d_1 - \frac{4}{(x-1)^5} + 4\Big)\ H(2,0,1,c_1(\alpha_0); x) + \Big(10 - \frac{10}{(x-1)^5}\Big)\ H(2,0,c_1(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{8}{(x-1)^5} - 8\Big)\ H(2,0,c_2(\alpha_0), c_1(\alpha_0); x) + \Big(\frac{8}{(x-1)^5} - 8\Big)\ H(2,1,0,0; x) + \Big(\frac{2}{(x-1)^5} - 2\Big) H(2,1,0,c_1(\alpha_0); x) + \Big(- \frac{4d_1}{(x-1)^5} + 4d_1 - \frac{2}{(x-1)^5} + 2\Big)\ H(2,1,1,0; x) + \Big(\frac{4d_1}{(x-1)^5} - 4\ d_1 + \frac{2}{(x-1)^5} - 2\Big)\ H(2,1,1,c_1(\alpha_0); x) + \Big(10 - \frac{10}{(x-1)^5}\Big)\ H(2,1,c_1(\alpha_0), c_1(\alpha_0); x) + \Big(- \frac{4d_1}{(x-1)^5} + 4\ d_1 + \frac{8}{(x-1)^5} - 8\Big) H(2,2,0,c_1(\alpha_0); x) + \Big(\frac{4\ d_1}{(x-1)^5} - 4d_1 - \frac{8}{(x-1)^5} + 8\Big)\ H(2,2,1,0; x) + \Big(- \frac{4d_1}{(x-1)^5} + 4\ d_1 + \frac{8}{(x-1)^5} - 8\Big) H(2,2,1,c_1(\alpha_0); x) +$

$$\left(\frac{4\ d_1}{(x-1)^5}-4d_1-\frac{8}{(x-1)^5}+8\right)\ H(2,2,c_2(\alpha_0),c_1(\alpha_0);x)+\left(4-\frac{4}{(x-1)^5}\right)\ H(2,c_2(\alpha_0),0,c_1(\alpha_0);x)+$$
$$\left(\frac{10}{(x-1)^5}-10\right)\ H(2,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\frac{4\ H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{12\ H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-$$
$$\frac{4H(c_1(\alpha_0),0,c_2(\ \alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{8\ H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\frac{28\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+$$
$$\frac{6\ H(c_1(\alpha_0),c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{4\ H(c_1(\alpha_0),c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}+\frac{10\ H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+$$
$$H(0;x)\ \left(-\frac{63d_1^2}{16(x-1)}+\frac{19d_1^2}{54(x-1)^2}+\frac{19\ d_1^2}{54(x-1)^3}-\frac{63d_1^2}{16(x-1)^4}-\frac{2035d_1^2}{432\ (x-1)^5}-\frac{2035d_1^2}{432}+\frac{38d_1}{3(x-2)}+\frac{85\ d_1}{24(x-1)}-\frac{76d_1}{9(x-2)^2}-\right.$$
$$\frac{317d_1}{108\ (x-1)^2}+\frac{313d_1}{108(x-1)^3}+\frac{257d_1}{8\ (x-1)^4}+\frac{8705d_1}{216(x-1)^5}+\frac{5615d_1}{216}-\frac{4\ \pi^2}{x-2}-\frac{68}{3(x-2)}+\frac{13\pi^2}{8(x-1)}+\frac{37}{4\ (x-1)}+\frac{8\pi^2}{3(x-2)^2}+$$
$$\frac{152}{9(x-2)^2}+\frac{5\pi\ ^2}{12(x-1)^2}-\frac{49}{108(x-1)^2}-\frac{8\pi^2}{3\ (x-2)^3}+\frac{3\pi^2}{4(x-1)^3}-\frac{949}{108(x-1)^3}+\frac{25\ \pi^2}{8(x-1)^4}-\frac{213}{4(x-1)^4}+\frac{25\pi^2}{8(x-1)^5}-\frac{3965}{54(x-1)^5}+$$
$$\left.\frac{3\zeta_3}{(x-1)^5}+16\zeta_3+\frac{2\ \pi^2\ln 2}{(x-1)^5}-2\pi^2\ln 2-\frac{25\pi\ ^2}{24}-\frac{940}{27}\right)+H(2;x)\left(-\frac{2\pi^2\ d_1}{x-2}+\frac{4\pi^2 d_1}{3(x-2)^2}+\frac{2\pi^2 d_1}{3\ (x-1)^2}-\frac{4\pi^2 d_1}{3(x-2)^3}+\right.$$
$$\frac{2\pi^2 d_1}{(x-1)^4}+\ \frac{4\pi^2}{x-2}-\frac{15\pi^2}{8(x-1)}-\frac{8\pi^2}{3\ (x-2)^2}-\frac{\pi^2}{12(x-1)^2}+\frac{8\pi^2}{3(x-2)^3}-\frac{5\ \pi^2}{4(x-1)^3}-\frac{17\pi^2}{8(x-1)^4}-\frac{25\pi^2}{8\ (x-1)^5}+\frac{7\zeta_3}{2(x-1)^5}-\frac{7\zeta_3}{2}-$$
$$\left.\frac{3\pi\ ^2\ln 2}{(x-1)^5}+3\pi^2\ln 2+\frac{25\pi\ ^2}{8}\right)+H(1;x)\left(-\frac{2\pi^2 d_1}{3(x-1)}+\frac{\pi^2\ d_1}{3(x-1)^2}-\frac{2\pi^2 d_1}{9(x-1)^3}+\frac{\pi^2 d_1}{6\ (x-1)^4}-\frac{25\pi^2 d_1}{18(x-1)^5}-\frac{3\zeta_3 d_1}{2\ (x-1)^5}-\right.$$
$$\frac{\pi^2\ln 2\, d_1}{(x-1)^5}+\left(-\frac{4\ d_1^2}{x-1}+\frac{d_1^2}{(x-1)^2}-\frac{4d_1^2}{9\ (x-1)^3}+\frac{d_1^2}{4(x-1)^4}-\frac{205d_1^2}{36\ (x-1)^5}+\frac{46d_1}{3(x-2)}+\frac{3d_1}{4(x-1)}-\frac{52d_1}{9\ (x-2)^2}-\frac{185d_1}{18(x-1)^2}+\right.$$
$$\frac{28d_1}{9(x-2)^3}+\frac{29\ d_1}{18(x-1)^3}-\frac{27d_1}{4(x-1)^4}+\frac{835d_1}{36(x-1)^5}+\ \frac{205d_1}{36}-\frac{80}{3(x-2)}+\frac{70}{3(x-1)}+\frac{56}{9\ (x-2)^2}+\frac{13}{18(x-1)^2}-\frac{56}{9(x-2)^3}+$$
$$\left.\frac{355}{18\ (x-1)^3}+\frac{10}{3(x-1)^4}-\frac{\pi^2}{6(x-1)^5}+\frac{155}{9\ (x-1)^5}+\frac{\pi^2}{6}-\frac{155}{9}\right)H(0;\alpha_0)+\left(-\frac{8\ d_1}{x-1}+\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2\ d_1}{(x-1)^4}-\right.$$
$$\left.\frac{50d_1}{3(x-1)^5}+\frac{16}{x-2}-\frac{10}{x-1}-\ \frac{32}{3(x-2)^2}+\frac{4}{3(x-1)^2}+\frac{32}{3\ (x-2)^3}-\frac{20}{3(x-1)^3}-\frac{6}{(x-1)^4}-\frac{50}{3(x-1)^5}+\ \frac{50}{3}\right)H(0,0;\alpha_0)+\left(-\right.$$
$$\frac{4d_1^2}{x-1}+\frac{2\ d_1^2}{(x-1)^2}-\frac{4d_1^2}{3\ (x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}+\frac{8\ d_1}{x-2}-\frac{5d_1}{x-1}-\frac{16d_1}{3(x-2)^2}+\frac{2d_1}{3\ (x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{10d_1}{3(x-1)^3}-\frac{3\ d_1}{(x-1)^4}-$$
$$\left.\frac{25d_1}{3(x-1)^5}+\frac{25d_1}{3}\right)\ H(0,1;\alpha_0)+\left(\frac{16}{(x-1)^5}-16\right)H(0,0,0;\alpha_0)+\left(\frac{8\ d_1}{(x-1)^5}-8d_1\right)H(0,0,1;\alpha_0)+\left(\frac{8d_1}{(x-1)^5}-\right.$$
$$\left.8\ d_1\right)H(0,1,0;\alpha_0)+\left(\frac{4d_1^2}{(x-1)^5}-4d_1^2\right)\ H(0,1,1;\alpha_0)+\frac{2\pi^2}{3(x-2)}+\frac{\pi^2}{4(x-1)}-\frac{4\ \pi^2}{9(x-2)^2}+\frac{4\pi^2}{9(x-2)^3}-\frac{11\pi^2}{18\ (x-1)^3}+$$
$$\left.\frac{5\pi^2}{6(x-1)^4}+\frac{25\pi^2}{18\ (x-1)^5}-\frac{21\zeta_3}{4(x-1)^5}+\frac{33\zeta_3}{4}+\frac{\pi\ ^2\ln 2}{2(x-1)^5}+\frac{3}{2}\pi^2\ln 2+\frac{125\pi\ ^2}{36}\right)-\frac{8d_1\pi^2}{3(x-2)}+\frac{37\pi^2}{6\ (x-2)}+\frac{65d_1\pi^2}{48(x-1)}-\frac{151\pi^2}{48\ (x-1)}+$$
$$\frac{7d_1\pi^2}{9(x-2)^2}-\frac{10\pi^2}{9\ (x-2)^2}+\frac{37d_1\pi^2}{54(x-1)^2}-\frac{847\pi^2}{432\ (x-1)^2}-\frac{7d_1\pi^2}{9(x-2)^3}+\frac{14\pi^2}{9\ (x-2)^3}+\frac{125d_1\pi^2}{108(x-1)^3}-\frac{1441\pi^2}{432\ (x-1)^3}+\frac{13d_1\pi^2}{8(x-1)^4}-$$
$$\frac{109\pi^2}{24\ (x-1)^4}-\frac{241\pi^4}{720(x-1)^5}+\frac{205d_1\pi^2}{216\ (x-1)^5}-\frac{155\pi^2}{54(x-1)^5}-\frac{7\zeta_3}{x-2}-\frac{85\ \zeta_3}{16(x-1)}+\frac{14\zeta_3}{3(x-2)^2}+\frac{61\zeta_3}{24\ (x-1)^2}-\frac{14\zeta_3}{3(x-2)^3}+\frac{25\zeta_3}{8\ (x-1)^3}-$$
$$\frac{43\zeta_3}{16(x-1)^4}-\frac{275\zeta_3}{16\ (x-1)^5}-\frac{1175\zeta_3}{48}-\frac{4\mathrm{Li}_4\frac{1}{2}}{(x-1)^5}+4\mathrm{Li}_4\frac{1}{2}-\frac{\ln^4 2}{6(x-1)^5}+\frac{\ln\ ^4 2}{6}-\frac{4\pi^2\ln^2 2}{3(x-1)^5}+\frac{4}{3}\pi^2\ \ln^2 2+\frac{6\pi^2\ln 2}{x-2}-$$
$$\frac{15\pi^2\ln 2}{8\ (x-1)}-\frac{4\pi^2\ln 2}{(x-2)^2}-\frac{3\pi^2\ln 2}{4\ (x-1)^2}+\frac{4\pi^2\ln 2}{(x-2)^3}-\frac{5\pi^2\ln 2}{4\ (x-1)^3}-\frac{33\pi^2\ln 2}{8(x-1)^4}-\frac{25\pi^2\ln 2}{8(x-1)^5}+\frac{25}{8}\pi^2\ln 2+\frac{\pi^4}{30}-\frac{205\ d_1\pi^2}{432}+\frac{305\pi^2}{432}.$$

E.5 The $\mathcal{B}$ integral for $k=0$ and $\delta=1$

The ε expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,0,1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,0)\\ &= \frac{1}{\varepsilon}b_{-1}^{(1,0)}+b_0^{(1,0)}+\varepsilon b_1^{(1,0)}+\varepsilon^2 b_2^{(1,0)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned} \tag{E.5}$$

where

$$b_{-1}^{(1,0)}=-\frac{1}{2},$$

$$b_0^{(1,0)}=\frac{\alpha_0^4}{4\ (x-1)}+\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\ (x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2\ (x-1)}-\frac{\alpha_0^2}{(x-1)^2}+\frac{\alpha_0^2}{2(x-1)^3}+3\ \alpha_0^2-\frac{\alpha_0}{x-1}+$$
$$\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}-4\alpha_0+\left(1+\frac{1}{(x-1)^5}\right)\ H(0;\alpha_0)+\left(1-\frac{1}{(x-1)^5}\right)\ H(0;x)+\frac{H(c_1(\alpha_0);x)}{(x-1)^5}-1,$$

$$
\begin{aligned}
&b_1^{(1,0)} = -\frac{d_1\alpha_0^4}{8} - \frac{d_1\alpha_0^4}{8(x-1)} + \frac{3\alpha_0^4}{4(x-1)} + \frac{3\alpha_0^4}{4} + \frac{13d_1\alpha_0^3}{18} + \frac{d_1\alpha_0^3}{2(x-1)} - \frac{3\alpha_0^3}{x-1} - \frac{2d_1\alpha_0^3}{9(x-1)^2} + \frac{23\alpha_0^3}{18(x-1)^2} - \frac{77\alpha_0^3}{18} - \\
&\frac{23d_1\alpha_0^2}{12} - \frac{3d_1\alpha_0^2}{4(x-1)} + \frac{53\alpha_0^2}{12(x-1)} + \frac{2d_1\alpha_0^2}{3(x-1)^2} - \frac{47\alpha_0^2}{12(x-1)^2} - \frac{d_1\alpha_0^2}{2(x-1)^3} + \frac{31\alpha_0^2}{12(x-1)^3} + \frac{131\alpha_0^2}{12} + \frac{25d_1\alpha_0}{6} + \frac{d_1\alpha_0}{2(x-1)} - \\
&\frac{7\alpha_0}{3(x-1)} - \frac{2d_1\alpha_0}{3(x-1)^2} + \frac{4\alpha_0}{(x-1)^2} + \frac{d_1\alpha_0}{(x-1)^3} - \frac{17\alpha_0}{3(x-1)^3} - \frac{2d_1\alpha_0}{(x-1)^4} + \frac{49\alpha_0}{6(x-1)^4} - \frac{121\alpha_0}{6} + \Big(- \frac{\alpha_0^4}{x-1} - \alpha_0^4 + \frac{4\alpha_0^3}{x-1} - \\
&\frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} - \frac{6\alpha_0^2}{x-1} + \frac{4\alpha_0^2}{(x-1)^2} - \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 + \frac{4\alpha_0}{x-1} - \frac{4\alpha_0}{(x-1)^2} + \frac{4\alpha_0}{(x-1)^3} - \frac{4\alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{5}{2(x-1)} + \\
&\frac{5}{3(x-1)^2} - \frac{5}{3(x-1)^3} + \frac{5}{2(x-1)^4} + \frac{37}{6(x-1)^5} - \frac{13}{6}\Big) H(0;\alpha_0) + \Big(\frac{37}{6} + \frac{5}{2(x-1)} - \frac{5}{3(x-1)^2} + \frac{5}{3(x-1)^3} - \frac{5}{2(x-1)^4} - \\
&\frac{37}{6(x-1)^5}\Big)H(0;x) + \Big(- \frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8d_1\alpha_0^3}{3} + \frac{2d_1\alpha_0^3}{x-1} - \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6d_1\alpha_0^2 - \frac{3d_1\alpha_0^2}{x-1} + \frac{2d_1\alpha_0^2}{(x-1)^2} - \frac{d_1\alpha_0^2}{(x-1)^3} + \\
&8d_1\alpha_0 + \frac{2d_1\alpha_0}{x-1} - \frac{2d_1\alpha_0}{(x-1)^2} + \frac{2d_1\alpha_0}{(x-1)^3} - \frac{2d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} - \frac{d_1}{2(x-1)} + \frac{2d_1}{3(x-1)^2} - \frac{d_1}{(x-1)^3} + \frac{2d_1}{(x-1)^4}\Big) H(1;\alpha_0) + \\
&\Big(\frac{2d_1}{(x-1)^5} - \frac{2}{(x-1)^5} + 2\Big)H(0;\alpha_0)\ H(1;x) + \Big(- \frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} - \frac{3\alpha_0^2}{x-1} + \frac{2\alpha_0^2}{(x-1)^2} - \\
&\frac{\alpha_0^2}{(x-1)^3} - 6\alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{4H(0;\alpha_0)}{(x-1)^5} - \frac{2d_1H(1;\alpha_0)}{(x-1)^5} - \frac{5}{2(x-1)} + \frac{5}{3(x-1)^2} - \\
&\frac{5}{3(x-1)^3} + \frac{5}{2(x-1)^4} + \frac{37}{6(x-1)^5} - \frac{25}{6}\Big) H(c_1(\alpha_0);x) + \Big(- 4 - \frac{4}{(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(\frac{4}{(x-1)^5} - \\
&4\Big)H(0,0;x) + \Big(- \frac{2d_1}{(x-1)^5} - 2d_1\Big)H(0,1;\alpha_0) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,c_1(\alpha_0);x) + \Big(- \frac{2d_1}{(x-1)^5} + \frac{2}{(x-1)^5} - \\
&2\Big) H(1,0;x) + \Big(\frac{2d_1}{(x-1)^5} - \frac{2}{(x-1)^5} + 2\Big)H(1,c_1(\alpha_0);x) - \frac{2H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} + \frac{\pi^2}{3(x-1)^5} - \frac{\pi^2}{3} - 2,
\end{aligned}
$$

$$
\begin{aligned}
&b_2^{(1,0)} = \\
&\frac{d_1^2\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{2} + \frac{d_1^2\alpha_0^4}{16(x-1)} - \frac{d_1\alpha_0^4}{2(x-1)} - \frac{\pi^2\alpha_0^4}{24(x-1)} + \frac{7\alpha_0^4}{4(x-1)} - \frac{\pi^2\alpha_0^4}{24} + \frac{7\alpha_0^4}{4} - \frac{43d_1^2\alpha_0^3}{108} + \frac{349d_1\alpha_0^3}{108} - \frac{d_1^2\alpha_0^3}{4(x-1)} + \frac{2d_1\alpha_0^3}{x-1} + \\
&\frac{\pi^2\alpha_0^3}{6(x-1)} - \frac{7\alpha_0^3}{x-1} + \frac{4d_1^2\alpha_0^3}{27(x-1)^2} - \frac{133d_1\alpha_0^3}{108(x-1)^2} - \frac{\pi^2\alpha_0^3}{18(x-1)^2} + \frac{191\alpha_0^3}{54(x-1)^2} + \frac{2\pi^2\alpha_0^3}{9} - \frac{569\alpha_0^3}{54} + \frac{95d_1^2\alpha_0^2}{72} - \frac{85d_1\alpha_0^2}{8} + \frac{3d_1^2\alpha_0^2}{8(x-1)} - \\
&\frac{203d_1\alpha_0^2}{72(x-1)} - \frac{\pi^2\alpha_0^2}{4(x-1)} + \frac{353\alpha_0^2}{36(x-1)} - \frac{4d_1^2\alpha_0^2}{9(x-1)^2} + \frac{31d_1\alpha_0^2}{8(x-1)^2} + \frac{\pi^2\alpha_0^2}{6(x-1)^2} - \frac{407\alpha_0^2}{36(x-1)^2} + \frac{d_1^2\alpha_0^2}{2(x-1)^3} - \frac{283d_1\alpha_0^2}{72(x-1)^3} - \frac{\pi^2\alpha_0^2}{12(x-1)^3} + \\
&\frac{331\alpha_0^2}{36(x-1)^3} - \frac{\pi^2\alpha_0^2}{2} + \frac{1091\alpha_0^2}{36} - \frac{205d_1^2\alpha_0}{36} + \frac{475d_1\alpha_0}{12} + \frac{2\alpha_0}{3(x-2)} - \frac{d_1^2\alpha_0}{4(x-1)} - \frac{d_1\alpha_0}{9(x-1)} + \frac{\pi^2\alpha_0}{6(x-1)} - \frac{13\alpha_0}{36(x-1)} + \frac{4d_1^2\alpha_0}{9(x-1)^2} - \\
&\frac{73d_1\alpha_0}{18(x-1)^2} - \frac{\pi^2\alpha_0}{6(x-1)^2} + \frac{35\alpha_0}{3(x-1)^2} - \frac{d_1^2\alpha_0}{(x-1)^3} + \frac{173d_1\alpha_0}{18(x-1)^3} + \frac{\pi^2\alpha_0}{6(x-1)^3} - \frac{875\alpha_0}{36(x-1)^3} + \frac{4d_1^2\alpha_0}{(x-1)^4} - \frac{937d_1\alpha_0}{36(x-1)^4} - \frac{\pi^2\alpha_0}{6(x-1)^4} + \\
&\frac{413\alpha_0}{9(x-1)^4} + \frac{2\pi^2\alpha_0}{3} - \frac{737\alpha_0}{9} + \Big(\frac{d_1\alpha_0^4}{2} + \frac{d_1\alpha_0^4}{2(x-1)} - \frac{3\alpha_0^4}{x-1} - 3\alpha_0^4 - \frac{26d_1\alpha_0^3}{9} - \frac{2d_1\alpha_0^3}{x-1} + \frac{12\alpha_0^3}{x-1} + \frac{8d_1\alpha_0^3}{9(x-1)^2} - \frac{46\alpha_0^3}{9(x-1)^2} + \\
&\frac{154\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{3} + \frac{3d_1\alpha_0^2}{x-1} - \frac{53\alpha_0^2}{3(x-1)} - \frac{8d_1\alpha_0^2}{3(x-1)^2} + \frac{47\alpha_0^2}{3(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} - \frac{31\alpha_0^2}{3(x-1)^3} - \frac{131\alpha_0^2}{3} - \frac{50d_1\alpha_0}{3} - \frac{2d_1\alpha_0}{x-1} + \frac{28\alpha_0}{3(x-1)} + \\
&\frac{8d_1\alpha_0}{3(x-1)^2} - \frac{16\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{68\alpha_0}{3(x-1)^3} + \frac{8d_1\alpha_0}{(x-1)^4} - \frac{98\alpha_0}{3(x-1)^4} + \frac{242\alpha_0}{3} + \frac{205d_1}{36} - \frac{4}{x-2} + \frac{17d_1}{4(x-1)} - \frac{53}{4(x-1)} + \frac{8}{3(x-2)^2} - \\
&\frac{13d_1}{9(x-1)^2} + \frac{317}{36(x-1)^2} + \frac{13d_1}{9(x-1)^3} - \frac{371}{36(x-1)^3} - \frac{17d_1}{4(x-1)^4} + \frac{193}{12(x-1)^4} - \frac{205d_1}{36(x-1)^5} - \frac{\pi^2}{6(x-1)^5} + \frac{266}{9(x-1)^5} - \frac{\pi^2}{6} - \\
&\frac{194}{9}\Big)H(0;\alpha_0) + \Big(-\frac{17d_1}{4(x-1)} + \frac{13d_1}{9(x-1)^2} - \frac{13d_1}{9(x-1)^3} + \frac{17d_1}{4(x-1)^4} + \frac{205d_1}{36(x-1)^5} - \frac{205d_1}{36} + \frac{4}{x-2} + \frac{53}{4(x-1)} - \frac{8}{3(x-2)^2} - \\
&\frac{317}{36(x-1)^2} + \frac{371}{36(x-1)^3} - \frac{193}{12(x-1)^4} - \frac{7\pi^2}{6(x-1)^5} - \frac{266}{9(x-1)^5} + \frac{3\pi^2}{2} + \frac{266}{9}\Big)H(0;x) + \Big(\frac{d_1^2\alpha_0^4}{4} - \frac{3d_1\alpha_0^4}{2} + \frac{d_1^2\alpha_0^4}{4(x-1)} - \\
&\frac{3d_1\alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{9} + \frac{77d_1\alpha_0^3}{9} - \frac{d_1^2\alpha_0^3}{x-1} + \frac{6d_1\alpha_0^3}{x-1} + \frac{4d_1^2\alpha_0^3}{9(x-1)^2} - \frac{23d_1\alpha_0^3}{9(x-1)^2} + \frac{23d_1^2\alpha_0^2}{6} - \frac{131d_1\alpha_0^2}{6} + \frac{3d_1^2\alpha_0^2}{2(x-1)} - \frac{53d_1\alpha_0^2}{6(x-1)} - \\
&\frac{4d_1^2\alpha_0^2}{3(x-1)^2} + \frac{47d_1\alpha_0^2}{6(x-1)^2} + \frac{d_1^2\alpha_0^2}{(x-1)^3} - \frac{31d_1\alpha_0^2}{6(x-1)^3} - \frac{25d_1^2\alpha_0}{3} + \frac{121d_1\alpha_0}{3} - \frac{d_1^2\alpha_0}{x-1} + \frac{14d_1\alpha_0}{3(x-1)} + \frac{4d_1^2\alpha_0}{3(x-1)^2} - \frac{8d_1\alpha_0}{(x-1)^2} - \frac{2d_1^2\alpha_0}{(x-1)^3} + \\
&\frac{34d_1\alpha_0}{3(x-1)^3} + \frac{4d_1^2\alpha_0}{(x-1)^4} - \frac{49d_1\alpha_0}{3(x-1)^4} + \frac{205d_1^2}{36} - \frac{230d_1}{9} + \frac{d_1^2}{4(x-1)} - \frac{d_1}{3(x-1)} - \frac{4d_1^2}{9(x-1)^2} + \frac{49d_1}{18(x-1)^2} + \frac{d_1^2}{(x-1)^3} - \frac{37d_1}{6(x-1)^3} - \\
&\frac{4d_1^2}{(x-1)^4} + \frac{49d_1}{3(x-1)^4}\Big)H(1;\alpha_0) + \Big(\frac{\pi^2}{2(x-1)^5} - \frac{\pi^2}{2}\Big)H(2;x) + \Big(\frac{4\alpha_0^4}{x-1} + 4\alpha_0^4 - \frac{16\alpha_0^3}{x-1} + \frac{16\alpha_0^3}{3(x-1)^2} - \frac{64\alpha_0^3}{3} + \frac{24\alpha_0^2}{x-1} - \\
&\frac{16\alpha_0^2}{(x-1)^2} + \frac{8\alpha_0^2}{(x-1)^3} + 48\alpha_0^2 - \frac{16\alpha_0}{x-1} + \frac{16\alpha_0}{(x-1)^2} - \frac{16\alpha_0}{(x-1)^3} + \frac{16\alpha_0}{(x-1)^4} - 64\alpha_0 + \frac{10}{x-1} - \frac{20}{3(x-1)^2} + \frac{20}{3(x-1)^3} - \frac{10}{(x-1)^4} - \\
&\frac{74}{3(x-1)^5} + \frac{26}{3}\Big) H(0,0;\alpha_0) + \Big(-\frac{74}{3} - \frac{10}{x-1} + \frac{20}{3(x-1)^2} - \frac{20}{3(x-1)^3} + \frac{10}{(x-1)^4} + \frac{74}{3(x-1)^5}\Big)H(0,0;x) + \Big(2d_1\alpha_0^4 + \\
&\frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} - \frac{8d_1\alpha_0^3}{x-1} + \frac{8d_1\alpha_0^3}{3(x-1)^2} + 24d_1\alpha_0^2 + \frac{12d_1\alpha_0^2}{x-1} - \frac{8d_1\alpha_0^2}{(x-1)^2} + \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 - \frac{8d_1\alpha_0}{x-1} + \frac{8d_1\alpha_0}{(x-1)^2} - \frac{8d_1\alpha_0}{(x-1)^3} + \\
&\frac{8d_1\alpha_0}{(x-1)^4} + \frac{13d_1}{3} + \frac{5d_1}{x-1} - \frac{10d_1}{3(x-1)^2} + \frac{10d_1}{3(x-1)^3} - \frac{5d_1}{(x-1)^4} - \frac{37d_1}{3(x-1)^5}\Big)H(0,1;\alpha_0) + H(1;x)\Big(\frac{2\pi^2d_1}{3(x-1)^5} + \Big(-\frac{4d_1}{x-1} +
\end{aligned}
$$

$$\frac{2d_1}{(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{d_1}{(x-1)^4} + \frac{37d_1}{3(x-1)^5} + \frac{4}{x-2} + \frac{5}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{3}{(x-1)^2} + \frac{8}{3(x-2)^3} + \frac{5}{3(x-1)^3} - \frac{13}{2(x-1)^4} -$$

$$\frac{37}{3(x-1)^5} + \frac{37}{3}\Big) H(0;\alpha_0) + \Big(-\frac{8d_1}{(x-1)^5} + \frac{8}{(x-1)^5} - 8\Big) H(0,0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + \frac{4d_1}{(x-1)^5} - 4d_1\Big) H(0,1;\alpha_0) -$$

$$\frac{2\pi^2}{3(x-1)^5} + \frac{\pi^2}{3}\Big) + \Big(-\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0)\, H(0,1;x) + \Big(\Big(\frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) +$$

$$\Big(\frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) + \frac{4}{x-2} + \frac{5}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{3}{(x-1)^2} + \frac{8}{3(x-2)^3} + \frac{5}{3(x-1)^3} - \frac{13}{2(x-1)^4} - \frac{37}{3(x-1)^5} +$$

$$\frac{37}{3}\Big) H(0,c_1(\alpha_0);x) + \Big(2d_1\alpha_0^4 + \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} - \frac{8d_1\alpha_0^3}{x-1} + \frac{8d_1\alpha_0^3}{3(x-1)^2} + 24d_1\alpha_0^2 + \frac{12d_1\alpha_0^2}{x-1} - \frac{8d_1\alpha_0^2}{(x-1)^2} + \frac{4d_1\alpha_0^2}{(x-1)^3} -$$

$$32d_1\alpha_0 - \frac{8d_1\alpha_0}{x-1} + \frac{8d_1\alpha_0}{(x-1)^2} - \frac{8d_1\alpha_0}{(x-1)^3} + \frac{8d_1\alpha_0}{(x-1)^4} + \frac{50d_1}{3} + \frac{2d_1}{x-1} - \frac{8d_1}{3(x-1)^2} + \frac{4d_1}{(x-1)^3} - \frac{8d_1}{(x-1)^4}\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1}{x-1} -$$

$$\frac{2d_1}{(x-1)^2} + \frac{4d_1}{3(x-1)^3} - \frac{d_1}{(x-1)^4} - \frac{37d_1}{3(x-1)^5} - \frac{4}{x-2} - \frac{5}{2(x-1)} + \frac{8}{3(x-2)^2} + \frac{3}{(x-1)^2} - \frac{8}{3(x-2)^3} - \frac{5}{3(x-1)^3} + \frac{13}{2(x-1)^4} +$$

$$\frac{37}{3(x-1)^5} - \frac{37}{3}\Big) H(1,0;x) + \Big(d_1^2\alpha_0^4 + \frac{d_1^2\alpha_0^4}{x-1} - \frac{16d_1^2\alpha_0^3}{3} - \frac{4d_1^2\alpha_0^3}{x-1} + \frac{4d_1^2\alpha_0^3}{3(x-1)^2} + 12d_1^2\alpha_0^2 + \frac{6d_1^2\alpha_0^2}{x-1} - \frac{4d_1^2\alpha_0^2}{(x-1)^2} + \frac{2d_1^2\alpha_0^2}{(x-1)^3} -$$

$$16d_1^2\alpha_0 - \frac{4d_1^2\alpha_0}{x-1} + \frac{4d_1^2\alpha_0}{(x-1)^2} - \frac{4d_1^2\alpha_0}{(x-1)^3} + \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{25d_1^2}{3} + \frac{d_1^2}{x-1} - \frac{4d_1^2}{3(x-1)^2} + \frac{2d_1^2}{(x-1)^3} - \frac{4d_1^2}{(x-1)^4}\Big) H(1,1;\alpha_0) +$$

$$H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{4} + \frac{d_1\alpha_0^4}{4(x-1)} - \frac{3\alpha_0^4}{2(x-1)} - \frac{3\alpha_0^4}{2} - \frac{13d_1\alpha_0^3}{9} - \frac{d_1\alpha_0^3}{x-1} + \frac{6\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{9(x-1)^2} - \frac{23\alpha_0^3}{9(x-1)^2} + \frac{77\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{6} -$$

$$\frac{\alpha_0^2}{3(x-2)} + \frac{3d_1\alpha_0^2}{2(x-1)} - \frac{103\alpha_0^2}{12(x-1)} - \frac{4d_1\alpha_0^2}{3(x-1)^2} + \frac{95\alpha_0^2}{12(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} - \frac{31\alpha_0^2}{6(x-1)^3} - \frac{131\alpha_0^2}{6} - \frac{25d_1\alpha_0}{3} + \frac{2\alpha_0}{x-2} - \frac{d_1\alpha_0}{x-1} +$$

$$\frac{10\alpha_0}{3(x-1)} - \frac{4\alpha_0}{3(x-2)^2} + \frac{4d_1\alpha_0}{3(x-1)^2} - \frac{15\alpha_0}{2(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{71\alpha_0}{6(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} - \frac{49\alpha_0}{3(x-1)^4} + \frac{121\alpha_0}{3} + \frac{205d_1}{36} + \Big(\frac{2\alpha_0^4}{x-1} +$$

$$2\alpha_0^4 - \frac{8\alpha_0^3}{x-1} + \frac{8\alpha_0^3}{3(x-1)^2} - \frac{32\alpha_0^3}{3} + \frac{12\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{4\alpha_0^2}{(x-1)^3} + 24\alpha_0^2 - \frac{8\alpha_0}{x-1} + \frac{8\alpha_0}{(x-1)^2} - \frac{8\alpha_0}{(x-1)^3} + \frac{8\alpha_0}{(x-1)^4} - 32\alpha_0 +$$

$$\frac{10}{x-1} - \frac{20}{3(x-1)^2} + \frac{20}{3(x-1)^3} - \frac{10}{(x-1)^4} - \frac{74}{3(x-1)^5} + \frac{50}{3}\Big) H(0;\alpha_0) + \Big(d_1\alpha_0^4 + \frac{d_1\alpha_0^4}{x-1} - \frac{16d_1\alpha_0^3}{3} - \frac{4d_1\alpha_0^3}{x-1} + \frac{4d_1\alpha_0^3}{3(x-1)^2} +$$

$$12d_1\alpha_0^2 + \frac{6d_1\alpha_0^2}{x-1} - \frac{4d_1\alpha_0^2}{(x-1)^2} + \frac{2d_1\alpha_0^2}{(x-1)^3} - 16d_1\alpha_0 - \frac{4d_1\alpha_0}{x-1} + \frac{4d_1\alpha_0}{(x-1)^2} - \frac{4d_1\alpha_0}{(x-1)^3} + \frac{4d_1\alpha_0}{(x-1)^4} + \frac{25d_1}{3} + \frac{5d_1}{x-1} - \frac{10d_1}{3(x-1)^2} +$$

$$\frac{10d_1}{3(x-1)^3} - \frac{5d_1}{(x-1)^4} - \frac{37d_1}{3(x-1)^5}\Big) H(1;\alpha_0) + \frac{16H(0,0;\alpha_0)}{(x-1)^5} + \frac{8d_1H(0,1;\alpha_0)}{(x-1)^5} + \frac{8d_1H(1,0;\alpha_0)}{(x-1)^5} + \frac{4d_1^2H(1,1;\alpha_0)}{(x-1)^5} - \frac{4}{x-2} +$$

$$\frac{17d_1}{4(x-1)} - \frac{53}{4(x-1)} + \frac{8}{3(x-2)^2} - \frac{13d_1}{9(x-1)^2} + \frac{317}{36(x-1)^2} + \frac{13d_1}{9(x-1)^3} - \frac{371}{36(x-1)^3} - \frac{17d_1}{4(x-1)^4} + \frac{193}{12(x-1)^4} - \frac{205d_1}{36(x-1)^5} -$$

$$\frac{\pi^2}{6(x-1)^5} + \frac{266}{9(x-1)^5} - \frac{230}{9}\Big) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} + 4d_1 + \frac{4}{(x-1)^5} - 2\Big) H(0;\alpha_0)H(1,1;x) + \Big(-\frac{4d_1}{x-1} + \frac{2d_1}{(x-1)^2} -$$

$$\frac{4d_1}{3(x-1)^3} + \frac{d_1}{(x-1)^4} + \frac{37d_1}{3(x-1)^5} + \Big(-\frac{8d_1}{(x-1)^5} + \frac{8}{(x-1)^5} - 8\Big) H(0;\alpha_0) + \Big(-\frac{4d_1^2}{(x-1)^5} + \frac{4d_1}{(x-1)^5} - 4d_1\Big) H(1;\alpha_0) +$$

$$\frac{4}{x-2} + \frac{5}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{3}{(x-1)^2} + \frac{8}{3(x-2)^3} + \frac{5}{3(x-1)^3} - \frac{13}{2(x-1)^4} - \frac{37}{3(x-1)^5} + \frac{37}{3}\Big) H(1,c_1(\alpha_0);x) + \Big(2 -$$

$$\frac{2}{(x-1)^5}\Big) H(0;\alpha_0)H(2,1;x) + \Big(\frac{\alpha_0^4}{x-1} + \frac{3\alpha_0^4}{2} - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} - 8\alpha_0^3 + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} + 18\alpha_0^2 -$$

$$\frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^4} - 24\alpha_0 + \frac{8H(0;\alpha_0)}{(x-1)^5} + \frac{4d_1H(1;\alpha_0)}{(x-1)^5} + \frac{7}{x-1} - \frac{13}{3(x-1)^2} + \frac{4}{(x-1)^3} - \frac{11}{2(x-1)^4} -$$

$$\frac{37}{3(x-1)^5} + \frac{25}{2}\Big) H(c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{x-1} + \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} + \frac{3\alpha_0^2}{x-1} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} -$$

$$6\alpha_0^2 - \frac{2\alpha_0}{x-1} + \frac{2\alpha_0}{(x-1)^2} - \frac{2\alpha_0}{(x-1)^3} + \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{4}{x-2} + \frac{1}{2(x-1)} + \frac{8}{3(x-2)^2} + \frac{2}{3(x-1)^2} - \frac{8}{3(x-2)^3} + \frac{1}{(x-1)^3} +$$

$$\frac{2}{(x-1)^4} - \frac{25}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0);x) + \Big(16 + \frac{16}{(x-1)^5}\Big) H(0,0,0;\alpha_0) + \Big(16 - \frac{16}{(x-1)^5}\Big) H(0,0,0;x) +$$

$$\Big(\frac{8d_1}{(x-1)^5} + 8d_1\Big) H(0,0,1;\alpha_0) + \Big(\frac{8}{(x-1)^5} - 8\Big) H(0,0,c_1(\alpha_0);x) + \Big(\frac{8d_1}{(x-1)^5} + 8d_1\Big) H(0,1,0;\alpha_0) +$$

$$\Big(\frac{4d_1}{(x-1)^5} - 4d_1 - \frac{8}{(x-1)^5} + 8\Big) H(0,1,0;x) + \Big(\frac{4d_1^2}{(x-1)^5} + 4d_1^2\Big) H(0,1,1;\alpha_0) + \Big(-\frac{4d_1}{(x-1)^5} + 4d_1 + \frac{8}{(x-1)^5} -$$

$$8\Big) H(0,1,c_1(\alpha_0);x) + \Big(\frac{4}{(x-1)^5} - 6\Big) H(0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,c_2(\alpha_0),c_1(\alpha_0);x) +$$

$$\Big(\frac{8d_1}{(x-1)^5} - \frac{8}{(x-1)^5} + 8\Big) H(1,0,0;x) + \Big(-\frac{4d_1}{(x-1)^5} + \frac{4}{(x-1)^5} - 2\Big) H(1,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1^2}{(x-1)^5} +$$

$$\frac{8d_1}{(x-1)^5} - 4d_1 - \frac{4}{(x-1)^5} + 2\Big) H(1,1,0;x) + \Big(\frac{4d_1^2}{(x-1)^5} - \frac{8d_1}{(x-1)^5} + 4d_1 + \frac{4}{(x-1)^5} - 2\Big) H(1,1,c_1(\alpha_0);x) +$$

$$\Big(-\frac{4d_1}{(x-1)^5} + \frac{4}{(x-1)^5} - 6\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(2,0,c_1(\alpha_0);x) + \Big(\frac{2}{(x-1)^5} -$$

$$2\Big) H(2,1,0;x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(2,1,c_1(\alpha_0);x) + \Big(\frac{2}{(x-1)^5} - 2\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) +$$

$\frac{4\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{2\ H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\frac{\pi^2}{x-2}-\frac{3\ \pi^2}{8(x-1)}+\frac{2\pi^2}{3(x-2)^2}+\frac{5\pi^2}{9\ (x-1)^2}-\frac{2\pi^2}{3(x-2)^3}-\frac{7\pi^2}{36\ (x-1)^3}+\frac{5\pi^2}{4(x-1)^4}+\frac{37\pi^2}{18\ (x-1)^5}-\frac{21\zeta_3}{4(x-1)^5}+\frac{17\zeta_3}{4}+\frac{\pi\ ^2\ln 2}{2(x-1)^5}-\frac{1}{2}\pi^2\ln 2-\frac{173\pi\ ^2}{72}-4.$

E.6 The $\mathcal{B}$ integral for $k=1$ and $\delta=1$

The ε expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,1,1,g_B)&=x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,1)\\&=\frac{1}{\varepsilon}b_{-1}^{(1,1)}+b_0^{(1,1)}+\varepsilon b_1^{(1,1)}+\varepsilon^2 b_2^{(1,1)}+\mathcal{O}\left(\varepsilon^3\right),\end{aligned}\tag{E.6}$$

where

$b_{-1}^{(1,1)}=-\frac{1}{4},$

$b_0^{(1,1)}=\frac{\alpha_0^4}{8(x-1)}+\frac{\alpha_0^4}{8}-\frac{\alpha_0^3}{2\ (x-1)}+\frac{\alpha_0^3}{6(x-1)^2}-\frac{2\alpha_0^3}{3}+\frac{3\alpha_0^2}{4\ (x-1)}-\frac{\alpha_0^2}{2(x-1)^2}+\frac{\alpha_0^2}{4(x-1)^3}+\frac{3\ \alpha_0^2}{2}-\frac{\alpha_0}{2(x-1)}+\frac{\alpha_0}{2(x-1)^2}-\frac{\alpha_0}{2\ (x-1)^3}+\frac{\alpha_0}{2(x-1)^4}-2\alpha_0+\left(\frac{1}{2}+\frac{1}{2\ (x-1)^5}\right)H(0;\alpha_0)+\left(\frac{1}{2}-\frac{1}{2(x-1)^5}\right)\ H(0;x)+\frac{H(c_1(\alpha_0);x)}{2(x-1)^5}-\frac{3}{4},$

$b_1^{(1,1)}=-\frac{d_1\alpha_0^4}{16}-\frac{d_1\alpha_0^4}{16(x-1)}+\frac{\alpha_0^4}{2\ (x-1)}+\frac{\alpha_0^4}{2}+\frac{13d_1\alpha_0^3}{36}-\frac{\alpha_0^3}{6(x-2)}+\frac{d_1\alpha_0^3}{4(x-1)}-\frac{23\alpha_0^3}{12(x-1)}-\frac{d_1\ \alpha_0^3}{9(x-1)^2}+\frac{29\alpha_0^3}{36(x-1)^2}-\frac{101\ \alpha_0^3}{36}-\frac{23d_1\alpha_0^2}{24}+\frac{5\alpha_0^2}{6(x-2)}-\frac{3\ d_1\alpha_0^2}{8(x-1)}+\frac{5\alpha_0^2}{2(x-1)}-\frac{2\alpha_0^2}{3\ (x-2)^2}+\frac{d_1\alpha_0^2}{3(x-1)^2}-\frac{7\alpha_0^2}{3\ (x-1)^2}-\frac{d_1\alpha_0^2}{4(x-1)^3}+\frac{37\alpha_0^2}{24\ (x-1)^3}+\frac{167\alpha_0^2}{24}+\frac{25d_1\alpha_0}{12}-\frac{7\alpha_0}{3\ (x-2)}+\frac{d_1\alpha_0}{4(x-1)}-\frac{\alpha_0}{12(x-1)}+\frac{10\alpha_0}{3\ (x-2)^2}-\frac{d_1\alpha_0}{3(x-1)^2}+\frac{11\alpha_0}{6(x-1)^2}-\frac{4\ \alpha_0}{(x-2)^3}+\frac{d_1\alpha_0}{2(x-1)^3}-\frac{37\alpha_0}{12\ (x-1)^3}-\frac{d_1\alpha_0}{(x-1)^4}+\frac{55\alpha_0}{12(x-1)^4}-\frac{145\ \alpha_0}{12}+\Big(-\frac{\alpha_0^4}{2(x-1)}-\frac{\alpha_0^4}{2}+\frac{2\ \alpha_0^3}{x-1}-\frac{2\alpha_0^3}{3(x-1)^2}+\frac{8\alpha_0^3}{3}-\frac{3\ \alpha_0^2}{x-1}+\frac{2\alpha_0^2}{(x-1)^2}-\frac{\alpha_0^2}{(x-1)^3}-6\ \alpha_0^2+\frac{2\alpha_0}{x-1}-\frac{2\alpha_0}{(x-1)^2}+\frac{2\ \alpha_0}{(x-1)^3}-\frac{2\alpha_0}{(x-1)^4}+8\ \alpha_0+\frac{4}{x-2}-\frac{5}{x-1}-\frac{16}{3(x-2)^2}+\frac{7}{4\ (x-1)^2}+\frac{8}{(x-2)^3}-\frac{5}{4\ (x-1)^3}-\frac{16}{(x-2)^4}+\frac{3}{2(x-1)^4}+\frac{43}{12\ (x-1)^5}-\frac{7}{12}\Big)H(0;\alpha_0)+\Big(\frac{5}{x-1}-\frac{7}{4\ (x-1)^2}+\frac{5}{4(x-1)^3}-\frac{3}{2(x-1)^4}-\frac{43}{12\ (x-1)^5}+\frac{43}{12}-\frac{4}{x-2}+\frac{16}{3\ (x-2)^2}-\frac{8}{(x-2)^3}+\frac{16}{(x-2)^4}\Big)\ H(0;x)+\Big(-\frac{d_1\alpha_0^4}{4}-\frac{d_1\alpha_0^4}{4(x-1)}+\frac{4\ d_1\alpha_0^3}{3}+\frac{d_1\alpha_0^3}{x-1}-\frac{d_1\alpha_0^3}{3(x-1)^2}-3d_1\ \alpha_0^2-\frac{3d_1\alpha_0^2}{2(x-1)}+\frac{d_1\alpha_0^2}{(x-1)^2}-\frac{d_1\ \alpha_0^2}{2(x-1)^3}+4d_1\alpha_0+\frac{d_1\alpha_0}{x-1}-\frac{d_1\ \alpha_0}{(x-1)^2}+\frac{d_1\alpha_0}{(x-1)^3}-\frac{d_1\ \alpha_0}{(x-1)^4}-\frac{25d_1}{12}-\frac{d_1}{4(x-1)}+\frac{d_1}{3\ (x-1)^2}-\frac{d_1}{2(x-1)^3}+\frac{d_1}{(x-1)^4}\Big)\ H(1;\alpha_0)+\Big(\frac{d_1}{(x-1)^5}-\frac{16}{(x-2)^5}-\frac{1}{(x-1)^5}\ +1\Big)H(0;\alpha_0)H(1;x)+\Big(\frac{\alpha_0^4}{4(x-2)}-\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-2}+\frac{\alpha_0^3}{x-1}+\frac{2\ \alpha_0^3}{3(x-2)^2}-\frac{\alpha_0^3}{3(x-1)^2}+\frac{4\alpha_0^3}{3}+\frac{3\ \alpha_0^2}{2(x-2)}-\frac{3\alpha_0^2}{2(x-1)}-\frac{2\ \alpha_0^2}{(x-2)^2}+\frac{\alpha_0^2}{(x-1)^2}+\frac{2\ \alpha_0^2}{(x-2)^3}-\frac{\alpha_0^2}{2(x-1)^3}-3\ \alpha_0^2-\frac{\alpha_0}{x-2}+\frac{\alpha_0}{x-1}+\frac{2\ \alpha_0}{(x-2)^2}-\frac{\alpha_0}{(x-1)^2}-\frac{4\ \alpha_0}{(x-2)^3}+\frac{\alpha_0}{(x-1)^3}+\frac{8\ \alpha_0}{(x-2)^4}-\frac{\alpha_0}{(x-1)^4}+4\alpha_0-\frac{2\ H(0;\alpha_0)}{(x-1)^5}-\frac{d_1\ H(1;\alpha_0)}{(x-1)^5}+\frac{4}{x-2}-\frac{5}{x-1}-\frac{16}{3\ (x-2)^2}+\frac{7}{4(x-1)^2}+\frac{8}{(x-2)^3}-\frac{5}{4\ (x-1)^3}-\frac{16}{(x-2)^4}+\frac{3}{2(x-1)^4}+\frac{43}{12\ (x-1)^5}-\frac{25}{12}\Big)\ H(c_1(\alpha_0);x)+\Big(-2-\frac{2}{(x-1)^5}\Big)\ H(0,0;\alpha_0)+\Big(\frac{2}{(x-1)^5}-2\Big)\ H(0,0;x)+\Big(-\frac{d_1}{(x-1)^5}-d_1\Big)\ H(0,1;\alpha_0)+\Big(-\frac{1}{(x-1)^5}+1-\frac{16}{(x-2)^5}\Big)H(0,c_1(\ \alpha_0);x)+\Big(-\frac{d_1}{(x-1)^5}+\frac{16}{(x-2)^5}+\frac{1}{(x-1)^5}\ -1\Big)H(1,0;x)+\Big(\frac{d_1}{(x-1)^5}-\frac{16}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Big)\ H(1,c_1(\alpha_0);x)-\frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{16\ H(c_2(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5}+\frac{4\pi^2}{(x-2)^5}+\frac{\pi\ ^2}{6(x-1)^5}-\frac{\pi^2}{6}-\frac{7}{4},$

$b_2^{(1,1)}=\frac{d_1^2\alpha_0^4}{32}-\frac{5d_1\alpha_0^4}{16}+\frac{d_1^2\alpha_0^4}{32\ (x-1)}-\frac{5d_1\alpha_0^4}{16(x-1)}-\frac{\pi^2\alpha_0^4}{48\ (x-1)}+\frac{11\alpha_0^4}{8(x-1)}-\frac{\pi^2\alpha_0^4}{48}+\frac{11\ \alpha_0^4}{8}-\frac{43d_1^2\alpha_0^3}{216}+\frac{427d_1\ \alpha_0^3}{216}+\frac{7d_1\alpha_0^3}{36(x-2)}-\frac{5\alpha_0^3}{9\ (x-2)}-\frac{d_1^2\alpha_0^3}{8(x-1)}+\frac{83d_1\alpha_0^3}{72\ (x-1)}+\frac{\pi^2\alpha_0^3}{12(x-1)}-\frac{47\alpha_0^3}{9(x-1)}+\frac{2\ d_1^2\alpha_0^3}{27(x-1)^2}-\frac{157d_1\alpha_0^3}{216(x-1)^2}-\frac{\pi\ ^2\alpha_0^3}{36(x-1)^2}+\frac{139\alpha_0^3}{54(x-1)^2}+\frac{\pi^2\ \alpha_0^3}{9}-\frac{218\alpha_0^3}{27}+\frac{95d_1^2\alpha_0^2}{144}-\frac{301\ d_1\alpha_0^2}{48}-\frac{41d_1\alpha_0^2}{36(x-2)}+\frac{28\alpha_0^2}{9\ (x-2)}+\frac{3d_1^2\alpha_0^2}{16(x-1)}-\frac{9d_1\alpha_0^2}{8\ (x-1)}-\frac{\pi^2\alpha_0^2}{8(x-1)}+\frac{151\alpha_0^2}{24\ (x-1)}+\frac{10d_1\alpha_0^2}{9(x-2)^2}-\frac{26\alpha_0^2}{9\ (x-2)^2}-\frac{2d_1^2\alpha_0^2}{9(x-1)^2}+\frac{25d_1\alpha_0^2}{12\ (x-1)^2}+\frac{\pi^2\alpha_0^2}{12(x-1)^2}-\frac{533\alpha_0^2}{72\ (x-1)^2}+\frac{d_1^2\alpha_0^2}{4(x-1)^3}-\frac{319d_1\alpha_0^2}{144\ (x-1)^3}-\frac{\pi^2\alpha_0^2}{24(x-1)^3}+\frac{221\alpha_0^2}{36\ (x-1)^3}-\frac{\pi^2\alpha_0^2}{4}+\frac{199\alpha_0^2}{9}-\frac{205d_1^2\ \alpha_0}{72}+\frac{175d_1\alpha_0}{8}+\frac{97d_1\alpha_0}{18(x-2)}-\frac{209\ \alpha_0}{18(x-2)}-\frac{d_1^2\alpha_0}{8(x-1)}-\frac{281d_1\alpha_0}{72\ (x-1)}+\frac{\pi^2\alpha_0}{12(x-1)}+\frac{191\alpha_0}{36(x-1)}-\frac{74\ d_1\alpha_0}{9(x-2)^2}+$

$$\frac{178\alpha_0}{9(x-2)^2}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-\frac{5d_1\alpha_0}{6(x-1)^2}-\frac{\pi^2\alpha_0}{12(x-1)^2}+\frac{65\alpha_0}{18(x-1)^2}+\frac{12d_1\alpha_0}{(x-2)^3}-\frac{28\alpha_0}{(x-2)^3}-\frac{d_1^2\alpha_0}{2(x-1)^3}+\frac{337d_1\alpha_0}{72(x-1)^3}+\frac{\pi^2\alpha_0}{12(x-1)^3}-$$

$$\frac{233\alpha_0}{18(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}-\frac{1009d_1\alpha_0}{72(x-1)^4}-\frac{\pi^2\alpha_0}{12(x-1)^4}+\frac{991\alpha_0}{36(x-1)^4}+\frac{\pi^2\alpha_0}{3}-\frac{1909\alpha_0}{36}+\Big(\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-$$

$$\frac{13d_1\alpha_0^3}{9}+\frac{2\alpha_0^3}{3(x-2)}-\frac{d_1\alpha_0^3}{x-1}+\frac{23\alpha_0^3}{3(x-1)}+\frac{4d_1\alpha_0^3}{9(x-1)^2}-\frac{29\alpha_0^3}{9(x-1)^2}+\frac{101\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{6}-\frac{10\alpha_0^2}{3(x-2)}+\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{10\alpha_0^2}{x-1}+\frac{8\alpha_0^2}{3(x-2)^2}-$$

$$\frac{4d_1\alpha_0^2}{3(x-1)^2}+\frac{28\alpha_0^2}{3(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{37\alpha_0^2}{6(x-1)^3}-\frac{167\alpha_0^2}{6}-\frac{25d_1\alpha_0}{3}+\frac{28\alpha_0}{3(x-2)}-\frac{d_1\alpha_0}{x-1}+\frac{\alpha_0}{3(x-1)}-\frac{40\alpha_0}{3(x-2)^2}+\frac{4d_1\alpha_0}{3(x-1)^2}-$$

$$\frac{22\alpha_0}{3(x-1)^2}+\frac{16\alpha_0}{(x-2)^3}-\frac{2d_1\alpha_0}{(x-1)^3}+\frac{37\alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{55\alpha_0}{3(x-1)^4}+\frac{145\alpha_0}{3}+\frac{205d_1}{72}-\frac{34d_1}{3(x-2)}+\frac{4}{x-2}+\frac{40d_1}{3(x-1)}-\frac{155}{12(x-1)}+$$

$$\frac{116d_1}{9(x-2)^2}-\frac{88}{9(x-2)^2}-\frac{47d_1}{24(x-1)^2}+\frac{103}{12(x-1)^2}-\frac{16d_1}{(x-2)^3}+\frac{24}{(x-2)^3}+\frac{25d_1}{24(x-1)^3}-\frac{103}{12(x-1)^3}+\frac{32d_1}{(x-2)^4}-\frac{80}{(x-2)^4}-$$

$$\frac{9d_1}{4(x-1)^4}+\frac{145}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi^2}{12(x-1)^5}+\frac{661}{36(x-1)^5}-\frac{\pi^2}{12}-\frac{409}{36}\Big)H(0;\alpha_0)+\Big(\frac{34d_1}{3(x-2)}-\frac{40d_1}{3(x-1)}-\frac{116d_1}{9(x-2)^2}+$$

$$\frac{47d_1}{24(x-1)^2}+\frac{16d_1}{(x-2)^3}-\frac{25d_1}{24(x-1)^3}-\frac{32d_1}{(x-2)^4}+\frac{9d_1}{4(x-1)^4}+\frac{205d_1}{72(x-1)^5}-\frac{205d_1}{72}-\frac{4}{x-2}+\frac{155}{12(x-1)}+\frac{88}{9(x-2)^2}-\frac{103}{12(x-1)^2}-$$

$$\frac{24}{(x-2)^3}+\frac{103}{12(x-1)^3}+\frac{80}{(x-2)^4}-\frac{145}{12(x-1)^4}-\frac{16\pi^2}{(x-2)^5}-\frac{7\pi^2}{12(x-1)^5}-\frac{661}{36(x-1)^5}+\frac{3\pi^2}{4}+\frac{661}{36}\Big)H(0;x)+\Big(\frac{d_1^2\alpha_0^4}{8}-$$

$$d_1\alpha_0^4+\frac{d_1^2\alpha_0^4}{8(x-1)}-\frac{d_1\alpha_0^4}{x-1}-\frac{13d_1^2\alpha_0^3}{18}+\frac{101d_1\alpha_0^3}{18}+\frac{d_1\alpha_0^3}{3(x-2)}-\frac{d_1^2\alpha_0^3}{2(x-1)}+\frac{23d_1\alpha_0^3}{6(x-1)}+\frac{2d_1^2\alpha_0^3}{9(x-1)^2}-\frac{29d_1\alpha_0^3}{18(x-1)^2}+\frac{23d_1^2\alpha_0^2}{12}-$$

$$\frac{167d_1\alpha_0^2}{12}-\frac{5d_1\alpha_0^2}{3(x-2)}+\frac{3d_1^2\alpha_0^2}{4(x-1)}-\frac{5d_1\alpha_0^2}{x-1}+\frac{4d_1\alpha_0^2}{3(x-2)^2}-\frac{2d_1^2\alpha_0^2}{3(x-1)^2}+\frac{14d_1\alpha_0^2}{3(x-1)^2}+\frac{d_1^2\alpha_0^2}{2(x-1)^3}-\frac{37d_1\alpha_0^2}{12(x-1)^3}-\frac{25d_1^2\alpha_0}{6}+\frac{145d_1\alpha_0}{6}+$$

$$\frac{14d_1\alpha_0}{3(x-2)}-\frac{d_1^2\alpha_0}{2(x-1)}+\frac{d_1\alpha_0}{6(x-1)}-\frac{20d_1\alpha_0}{3(x-2)^2}+\frac{2d_1^2\alpha_0}{3(x-1)^2}-\frac{11d_1\alpha_0}{3(x-1)^2}+\frac{8d_1\alpha_0}{(x-2)^3}-\frac{d_1^2\alpha_0}{(x-1)^3}+\frac{37d_1\alpha_0}{6(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}-\frac{55d_1\alpha_0}{6(x-1)^4}+$$

$$\frac{205d_1^2}{72}-\frac{535d_1}{36}-\frac{10d_1}{3(x-2)}+\frac{d_1^2}{8(x-1)}+\frac{2d_1}{x-1}+\frac{16d_1}{3(x-2)^2}-\frac{2d_1^2}{9(x-1)^2}+\frac{11d_1}{18(x-1)^2}-\frac{8d_1}{(x-2)^3}+\frac{d_1^2}{2(x-1)^3}-\frac{37d_1}{12(x-1)^3}-$$

$$\frac{2d_1^2}{(x-1)^4}+\frac{55d_1}{6(x-1)^4}\Big)H(1;\alpha_0)+\Big(-\frac{8\pi^2d_1}{(x-2)^5}+\frac{16\pi^2}{(x-2)^5}+\frac{\pi^2}{4(x-1)^5}-\frac{\pi^2}{4}\Big)H(2;x)+\Big(\frac{2\alpha_0^4}{x-1}+2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)^2}-$$

$$\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2-\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}-32\alpha_0-\frac{16}{x-2}+\frac{20}{x-1}+\frac{64}{3(x-2)^2}-$$

$$\frac{7}{(x-1)^2}-\frac{32}{(x-2)^3}+\frac{5}{(x-1)^3}+\frac{64}{(x-2)^4}-\frac{6}{(x-1)^4}-\frac{43}{3(x-1)^5}+\frac{7}{3}\Big)H(0,0;\alpha_0)+\Big(-\frac{20}{x-1}+\frac{7}{(x-1)^2}-\frac{5}{(x-1)^3}+$$

$$\frac{6}{(x-1)^4}+\frac{43}{3(x-1)^5}-\frac{43}{3}+\frac{16}{x-2}-\frac{64}{3(x-2)^2}+\frac{32}{(x-2)^3}-\frac{64}{(x-2)^4}\Big)H(0,0;x)+\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+$$

$$\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{7d_1}{6}-\frac{8d_1}{x-2}+$$

$$\frac{10d_1}{x-1}+\frac{32d_1}{3(x-2)^2}-\frac{7d_1}{2(x-1)^2}-\frac{16d_1}{(x-2)^3}+\frac{5d_1}{2(x-1)^3}+\frac{32d_1}{(x-2)^4}-\frac{3d_1}{(x-1)^4}-\frac{43d_1}{6(x-1)^5}\Big)H(0,1;\alpha_0)+H(1;x)\Big(\frac{\pi^2d_1}{3(x-1)^5}+$$

$$\Big(\frac{15d_1}{2(x-2)}-\frac{19d_1}{2(x-1)}-\frac{28d_1}{3(x-2)^2}+\frac{17d_1}{6(x-1)^2}+\frac{12d_1}{(x-2)^3}-\frac{3d_1}{2(x-1)^3}-\frac{16d_1}{(x-2)^4}+\frac{d_1}{(x-1)^4}+\frac{43d_1}{6(x-1)^5}+\frac{11}{2(x-2)}-\frac{5}{2(x-1)}-$$

$$\frac{16}{3(x-2)^2}-\frac{7}{12(x-1)^2}+\frac{16}{3(x-2)^3}+\frac{5}{12(x-1)^3}-\frac{3}{(x-1)^4}-\frac{16}{(x-2)^5}-\frac{43}{6(x-1)^5}+\frac{43}{6}\Big)H(0;\alpha_0)+\Big(-\frac{4d_1}{(x-1)^5}+\frac{64}{(x-2)^5}+$$

$$\frac{4}{(x-1)^5}-4\Big)H(0,0;\alpha_0)+\Big(-\frac{2d_1^2}{(x-1)^5}+\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-2d_1\Big)H(0,1;\alpha_0)+\frac{8\pi^2}{3(x-2)^5}-\frac{\pi^2}{3(x-1)^5}+\frac{\pi^2}{6}\Big)+$$

$$\Big(-\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+2d_1+\frac{32}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)\,H(0,1;x)+\Big(\frac{\alpha_0^4}{2(x-2)}-\frac{2\alpha_0^3}{x-2}+\frac{4\alpha_0^3}{3(x-2)^2}+\frac{3\alpha_0^2}{x-2}-$$

$$\frac{4\alpha_0^2}{(x-2)^2}+\frac{4\alpha_0^2}{(x-2)^3}-\frac{2\alpha_0}{x-2}+\frac{4\alpha_0}{(x-2)^2}-\frac{8\alpha_0}{(x-2)^3}+\frac{16\alpha_0}{(x-2)^4}+\Big(\frac{4}{(x-1)^5}-4+\frac{64}{(x-2)^5}\Big)H(0;\alpha_0)+\Big(\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-$$

$$2d_1\Big)H(1;\alpha_0)+\frac{6}{x-2}-\frac{5}{2(x-1)}-\frac{20}{3(x-2)^2}-\frac{7}{12(x-1)^2}+\frac{28}{3(x-2)^3}+\frac{5}{12(x-1)^3}-\frac{16}{(x-2)^4}-\frac{3}{(x-1)^4}-\frac{16}{(x-2)^5}-$$

$$\frac{43}{6(x-1)^5}+\frac{43}{6}\Big)H(0,c_1(\alpha_0);x)+\Big(d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+$$

$$\frac{2d_1\alpha_0^2}{(x-1)^3}-16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}+\frac{25d_1}{3}+\frac{d_1}{x-1}-\frac{4d_1}{3(x-1)^2}+\frac{2d_1}{(x-1)^3}-\frac{4d_1}{(x-1)^4}\Big)H(1,0;\alpha_0)+$$

$$\Big(-\frac{15d_1}{2(x-2)}+\frac{19d_1}{2(x-1)}+\frac{28d_1}{3(x-2)^2}-\frac{17d_1}{6(x-1)^2}-\frac{12d_1}{(x-2)^3}+\frac{3d_1}{2(x-1)^3}+\frac{16d_1}{(x-2)^4}-\frac{d_1}{(x-1)^4}-\frac{43d_1}{6(x-1)^5}-\frac{11}{2(x-2)}+\frac{5}{2(x-1)}+$$

$$\frac{16}{3(x-2)^2}+\frac{7}{12(x-1)^2}-\frac{16}{3(x-2)^3}-\frac{5}{12(x-1)^3}+\frac{3}{(x-1)^4}+\frac{16}{(x-2)^5}+\frac{43}{6(x-1)^5}-\frac{43}{6}\Big)H(1,0;x)+\Big(\frac{d_1^2\alpha_0^4}{2}+\frac{d_1^2\alpha_0^4}{2(x-1)}-$$

$$\frac{8d_1^2\alpha_0^3}{3}-\frac{2d_1^2\alpha_0^3}{x-1}+\frac{2d_1^2\alpha_0^3}{3(x-1)^2}+6d_1^2\alpha_0^2+\frac{3d_1^2\alpha_0^2}{x-1}-\frac{2d_1^2\alpha_0^2}{(x-1)^2}+\frac{d_1^2\alpha_0^2}{(x-1)^3}-8d_1^2\alpha_0-\frac{2d_1^2\alpha_0}{x-1}+\frac{2d_1^2\alpha_0}{(x-1)^2}-\frac{2d_1^2\alpha_0}{(x-1)^3}+\frac{2d_1^2\alpha_0}{(x-1)^4}+$$

$$\frac{25d_1^2}{6}+\frac{d_1^2}{2(x-1)}-\frac{2d_1^2}{3(x-1)^2}+\frac{d_1^2}{(x-1)^3}-\frac{2d_1^2}{(x-1)^4}\Big)H(1,1;\alpha_0)+H(c_1(\alpha_0);x)\Big(\frac{d_1\alpha_0^4}{8}-\frac{d_1\alpha_0^4}{8(x-2)}+\frac{\alpha_0^4}{2(x-2)}+$$

$$\frac{d_1\alpha_0^4}{8(x-1)}-\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{13d_1\alpha_0^3}{18}+\frac{d_1\alpha_0^3}{2(x-2)}-\frac{5\alpha_0^3}{3(x-2)}-\frac{d_1\alpha_0^3}{2(x-1)}+\frac{43\alpha_0^3}{12(x-1)}-\frac{4d_1\alpha_0^3}{9(x-2)^2}+\frac{14\alpha_0^3}{9(x-2)^2}+\frac{2d_1\alpha_0^3}{9(x-1)^2}-$$

$$\frac{29\alpha_0^3}{18(x-1)^2}+\frac{101\alpha_0^3}{18}+\frac{23\ d_1\alpha_0^2}{12}-\frac{3d_1\alpha_0^2}{4(x-2)}+\frac{11\alpha_0^2}{12(x-2)}+\frac{3d_1\alpha_0^2}{4(x-1)}-\frac{7\alpha_0^2}{2(x-1)}+\frac{4d_1\ \alpha_0^2}{3(x-2)^2}-\frac{10\alpha_0^2}{3(x-2)^2}-\frac{2d_1\alpha_0^2}{3\ (x-1)^2}+\frac{13\alpha_0^2}{3(x-1)^2}-$$

$$\frac{2d_1\ \alpha_0^2}{(x-2)^3}+\frac{6\alpha_0^2}{(x-2)^3}+\frac{d_1\alpha_0^2}{2\ (x-1)^3}-\frac{37\alpha_0^2}{12(x-1)^3}-\frac{167\alpha_0^2}{12}-\frac{25\ d_1\alpha_0}{6}+\frac{d_1\alpha_0}{2(x-2)}+\frac{37\alpha_0}{6(x-2)}-\frac{d_1\ \alpha_0}{2(x-1)}-\frac{21\alpha_0}{4(x-1)}-\frac{4d_1\alpha_0}{3\ (x-2)^2}-$$

$$\frac{14\alpha_0}{3(x-2)^2}+\frac{2d_1\alpha_0}{3\ (x-1)^2}-\frac{17\alpha_0}{12(x-1)^2}+\frac{4d_1\alpha_0}{(x-2)^3}-\frac{4\ \alpha_0}{(x-2)^3}-\frac{d_1\alpha_0}{(x-1)^3}+\frac{17\alpha_0}{3\ (x-1)^3}-\frac{16d_1\alpha_0}{(x-2)^4}+\frac{40\alpha_0}{(x-2)^4}+\frac{2\ d_1\alpha_0}{(x-1)^4}-\frac{55\alpha_0}{6(x-1)^4}+$$

$$\frac{145\ \alpha_0}{6}+\frac{205d_1}{72}+\Bigg(-\frac{\alpha_0^4}{x-2}+\frac{\alpha_0^4}{x-1}+\alpha_0^4+\frac{4\alpha_0^3}{x-2}-\frac{4\alpha_0^3}{x-1}-\frac{8\alpha_0^3}{3\ (x-2)^2}+\frac{4\alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\ \alpha_0^2}{x-2}+\frac{6\alpha_0^2}{x-1}+\frac{8\alpha_0^2}{(x-2)^2}-\frac{4\ \alpha_0^2}{(x-1)^2}-$$

$$\frac{8\alpha_0^2}{(x-2)^3}+\frac{2\alpha_0^2}{(x-1)^3}+12\ \alpha_0^2+\frac{4\alpha_0}{x-2}-\frac{4\alpha_0}{x-1}-\frac{8\ \alpha_0}{(x-2)^2}+\frac{4\alpha_0}{(x-1)^2}+\frac{16\alpha_0}{(x-2)^3}-\frac{4\ \alpha_0}{(x-1)^3}-\frac{32\alpha_0}{(x-2)^4}+\frac{4\alpha_0}{(x-1)^4}-16\ \alpha_0-\frac{16}{x-2}+$$

$$\frac{20}{x-1}+\frac{64}{3\ (x-2)^2}-\frac{7}{(x-1)^2}-\frac{32}{(x-2)^3}+\frac{5}{(x-1)^3}+\frac{64}{(x-2)^4}-\frac{6}{(x-1)^4}-\frac{43}{3(x-1)^5}+\frac{25}{3}\Bigg)\ H(0;\alpha_0)+\Bigg(\frac{d_1\alpha_0^4}{2}-\frac{d_1\alpha_0^4}{2(x-2)}+$$

$$\frac{d_1\ \alpha_0^4}{2(x-1)}-\frac{8d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{x-2}-\frac{2\ d_1\alpha_0^3}{x-1}-\frac{4d_1\alpha_0^3}{3(x-2)^2}+\frac{2d_1\alpha_0^3}{3\ (x-1)^2}+6d_1\alpha_0^2-\frac{3d_1\alpha_0^2}{x-2}+\frac{3d_1\alpha_0^2}{x-1}+\frac{4d_1\alpha_0^2}{(x-2)^2}-\frac{2d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\ \alpha_0^2}{(x-2)^3}+$$

$$\frac{d_1\alpha_0^2}{(x-1)^3}-8d_1\alpha_0+\frac{2d_1\ \alpha_0}{x-2}-\frac{2d_1\alpha_0}{x-1}-\frac{4d_1\alpha_0}{(x-2)^2}+\frac{2d_1\ \alpha_0}{(x-1)^2}+\frac{8d_1\alpha_0}{(x-2)^3}-\frac{2d_1\ \alpha_0}{(x-1)^3}-\frac{16d_1\alpha_0}{(x-2)^4}+\frac{2d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{6}-\frac{8d_1}{x-2}+\frac{10\ d_1}{x-1}+$$

$$\frac{32d_1}{3(x-2)^2}-\frac{7d_1}{2(x-1)^2}-\frac{16\ d_1}{(x-2)^3}+\frac{5d_1}{2(x-1)^3}+\frac{32d_1}{(x-2)^4}-\frac{3\ d_1}{(x-1)^4}-\frac{43d_1}{6(x-1)^5}\Bigg)H(1;\alpha_0)+\frac{8\ H(0,0;\alpha_0)}{(x-1)^5}+\frac{4d_1H(0,1;\alpha_0)}{(x-1)^5}+$$

$$\frac{4d_1\ H(1,0;\alpha_0)}{(x-1)^5}+\frac{2d_1^2H(1,1;\alpha_0)}{(x-1)^5}-\frac{34\ d_1}{3(x-2)}+\frac{4}{x-2}+\frac{40d_1}{3(x-1)}-\frac{155}{12\ (x-1)}+\frac{116d_1}{9(x-2)^2}-\frac{88}{9(x-2)^2}-\frac{47\ d_1}{24(x-1)^2}+\frac{103}{12(x-1)^2}-$$

$$\frac{16\ d_1}{(x-2)^3}+\frac{24}{(x-2)^3}+\frac{25d_1}{24\ (x-1)^3}-\frac{103}{12(x-1)^3}+\frac{32\ d_1}{(x-2)^4}-\frac{80}{(x-2)^4}-\frac{9d_1}{4\ (x-1)^4}+\frac{145}{12(x-1)^4}-\frac{205d_1}{72(x-1)^5}-\frac{\pi\ ^2}{12(x-1)^5}+$$

$$\frac{661}{36\ (x-1)^5}-\frac{535}{36}\Bigg)+\Bigg(\frac{2d_1^2}{(x-1)^5}-\frac{32\ d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2\ d_1-\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Bigg)H(0;\alpha_0)\ H(1,1;x)+\Bigg(\frac{15d_1}{2(x-2)}-$$

$$\frac{19d_1}{2(x-1)}-\frac{28\ d_1}{3(x-2)^2}+\frac{17d_1}{6(x-1)^2}+\frac{12\ d_1}{(x-2)^3}-\frac{3d_1}{2(x-1)^3}-\frac{16\ d_1}{(x-2)^4}+\frac{d_1}{(x-1)^4}+\frac{43d_1}{6\ (x-1)^5}+\Bigg(-\frac{4\ d_1}{(x-1)^5}+\frac{64}{(x-2)^5}+\frac{4}{(x-1)^5}-$$

$$4\Bigg)\ H(0;\alpha_0)+\Bigg(-\frac{2d_1^2}{(x-1)^5}+\frac{32d_1}{(x-2)^5}+\frac{2\ d_1}{(x-1)^5}-2d_1\Bigg)H(1;\alpha_0)+\frac{11}{2(x-2)}-\frac{5}{2\ (x-1)}-\frac{16}{3(x-2)^2}-\frac{7}{12(x-1)^2}+$$

$$\frac{16}{3\ (x-2)^3}+\frac{5}{12\ (x-1)^3}-\frac{3}{(x-1)^4}-\frac{16}{(x-2)^5}-\frac{43}{6\ (x-1)^5}+\frac{43}{6}\Bigg)H(1,c_1(\alpha_0);x)+\Bigg(\frac{32\ d_1}{(x-2)^5}-\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+$$

$$1\Bigg)H(0;\alpha_0)\ H(2,1;x)+\Bigg(-\frac{5\alpha_0^4}{4(x-2)}+\frac{\alpha_0^4}{2(x-1)}+\frac{3\ \alpha_0^4}{4}+\frac{5\alpha_0^3}{x-2}-\frac{2\alpha_0^3}{x-1}-\frac{10\alpha_0^3}{3\ (x-2)^2}+\frac{2\alpha_0^3}{3(x-1)^2}-4\alpha_0^3-\frac{15\alpha_0^2}{2\ (x-2)}+$$

$$\frac{3\alpha_0^2}{x-1}+\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\ \alpha_0^2}{(x-1)^2}-\frac{10\alpha_0^2}{(x-2)^3}+\frac{\alpha_0^2}{(x-1)^3}+9\ \alpha_0^2+\frac{5\alpha_0}{x-2}-\frac{2\alpha_0}{x-1}-\frac{10\ \alpha_0}{(x-2)^2}+\frac{2\alpha_0}{(x-1)^2}+\frac{20\alpha_0}{(x-2)^3}-\frac{2\ \alpha_0}{(x-1)^3}-\frac{40\alpha_0}{(x-2)^4}+$$

$$\frac{2\alpha_0}{(x-1)^4}-12\ \alpha_0+\frac{4H(0;\alpha_0)}{(x-1)^5}+\frac{2d_1\ H(1;\alpha_0)}{(x-1)^5}-\frac{20}{x-2}+\frac{89}{4(x-1)}+\frac{80}{3\ (x-2)^2}-\frac{27}{4(x-1)^2}-\frac{40}{(x-2)^3}+\frac{49}{12\ (x-1)^3}+\frac{80}{(x-2)^4}-$$

$$\frac{4}{(x-1)^4}-\frac{43}{6\ (x-1)^5}+\frac{25}{4}\Bigg)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{\alpha_0^4}{4\ (x-1)}-\frac{\alpha_0^4}{4}-\frac{\alpha_0^3}{x-1}+\frac{\alpha_0^3}{3\ (x-1)^2}+\frac{4\alpha_0^3}{3}+\frac{3\alpha_0^2}{2\ (x-1)}-\frac{\alpha_0^2}{(x-1)^2}+$$

$$\frac{\alpha_0^2}{2(x-1)^3}-3\ \alpha_0^2-\frac{\alpha_0}{x-1}+\frac{\alpha_0}{(x-1)^2}-\frac{\alpha_0}{(x-1)^3}+\frac{\alpha_0}{(x-1)^4}+4\alpha_0-\frac{64H(0;\alpha_0)}{(x-2)^5}-\frac{32d_1\ H(1;\alpha_0)}{(x-2)^5}-\frac{2}{x-2}+\frac{1}{4(x-1)}+\frac{4}{3\ (x-2)^2}+$$

$$\frac{1}{3(x-1)^2}-\frac{4}{3(x-2)^3}+\frac{1}{2(x-1)^3}+\frac{1}{(x-1)^4}+\frac{16}{(x-2)^5}-\frac{25}{12}\Bigg)\ H(c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(8+\frac{8}{(x-1)^5}\Bigg)\ H(0,0,0;\alpha_0)+$$

$$\Bigg(8-\frac{8}{(x-1)^5}\Bigg)H(0,0,0;x)+\Bigg(\frac{4\ d_1}{(x-1)^5}+4d_1\Bigg)\ H(0,0,1;\alpha_0)+\Bigg(\frac{4}{(x-1)^5}-4+\frac{32}{(x-2)^5}\Bigg)\ H(0,0,c_1(\alpha_0);x)+$$

$$\Bigg(\frac{4d_1}{(x-1)^5}+4d_1\Bigg)H(0,1,0;\alpha_0)+\ \Bigg(\frac{32d_1}{(x-2)^5}+\frac{2d_1}{(x-1)^5}-2\ d_1-\frac{32}{(x-2)^5}-\frac{4}{(x-1)^5}+4\Bigg)\ H(0,1,0;x)+\Bigg(\frac{2d_1^2}{(x-1)^5}+$$

$$2d_1^2\Bigg)\ H(0,1,1;\alpha_0)+\Bigg(-\frac{32d_1}{(x-2)^5}-\frac{2d_1}{(x-1)^5}+2\ d_1+\frac{32}{(x-2)^5}+\frac{4}{(x-1)^5}-4\Bigg)\ H(0,1,c_1(\alpha_0);x)+\Bigg(\frac{2}{(x-1)^5}-$$

$$3+\frac{80}{(x-2)^5}\Bigg)\ H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(-\frac{1}{(x-1)^5}+1-\frac{64}{(x-2)^5}\ \Bigg)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{4\ d_1}{(x-1)^5}-$$

$$\frac{64}{(x-2)^5}-\frac{4}{(x-1)^5}+4\Bigg)H(1,0,0;x)+\ \Bigg(-\frac{2\ d_1}{(x-1)^5}-\frac{16}{(x-2)^5}+\frac{2}{(x-1)^5}-1\Bigg)\ H(1,0,c_1(\alpha_0);x)+\Bigg(-\frac{2d_1^2}{(x-1)^5}+$$

$$\frac{32\ d_1}{(x-2)^5}+\frac{4d_1}{(x-1)^5}-2\ d_1+\frac{16}{(x-2)^5}-\frac{2}{(x-1)^5}+1\Bigg)\ H(1,1,0;x)+\Bigg(\frac{2d_1^2}{(x-1)^5}-\frac{32\ d_1}{(x-2)^5}-\frac{4d_1}{(x-1)^5}+2\ d_1-\frac{16}{(x-2)^5}+$$

$$\frac{2}{(x-1)^5}-1\Bigg)\ H(1,1,c_1(\alpha_0);x)+\Bigg(-\frac{2\ d_1}{(x-1)^5}+\frac{80}{(x-2)^5}+\frac{2}{(x-1)^5}-3\Bigg)\ H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{32\ d_1}{(x-2)^5}-$$

$$\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Bigg)\ H(2,0,c_1(\alpha_0);x)+\Bigg(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Bigg)H(2,1,0;x)+\ \Bigg(\frac{32\ d_1}{(x-2)^5}-$$

$$\frac{64}{(x-2)^5}-\frac{1}{(x-1)^5}+1\Bigg)\ H(2,1,c_1(\alpha_0);x)+\Bigg(-\frac{32\ d_1}{(x-2)^5}+\frac{64}{(x-2)^5}+\frac{1}{(x-1)^5}-1\Bigg)\ H(2,c_2(\alpha_0),c_1(\alpha_0);x)+$$

$$\frac{2\ H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\frac{32\ H(c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-2)^5}-\frac{80\ H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-2)^5}-$$

$$\frac{7\pi^2}{6\ (x-2)}+\frac{7\pi^2}{16(x-1)}+\frac{11\pi^2}{9\ (x-2)^2}+\frac{\pi^2}{8(x-1)^2}-\frac{5\pi^2}{3\ (x-2)^3}-\frac{\pi^2}{36(x-1)^3}+\frac{8\pi^2}{3(x-2)^4}+\frac{7\ \pi^2}{12(x-1)^4}+\frac{4\pi^2}{(x-2)^5}+$$

$\frac{43\pi^2}{36\ (x-1)^5} - \frac{28\zeta_3}{(x-2)^5} - \frac{21\zeta_3}{8\ (x-1)^5} + \frac{17\zeta_3}{8} + \frac{24\pi^2 \ln 2}{(x-2)^5} + \frac{\pi^2 \ln 2}{4(x-1)^5} - \frac{1}{4}\pi^2 \ln 2 \ - \frac{197\pi^2}{144} - \frac{15}{4}$

E.7 The $\mathcal{B}$ integral for $k = 2$ and $\delta = 1$ and $d_1 = -3$

The ε expansion for this integral reads

$$\begin{aligned} \mathcal{I}(x, \varepsilon; \alpha_0, 3 + d_1\varepsilon; 1, 2, 1, g_B) &= x\, \mathcal{B}(\varepsilon, x; 3 + d_1\varepsilon; 1, 2) \\ &= \frac{1}{\varepsilon} b_{-1}^{(1,2)} + b_0^{(1,2)} + \varepsilon b_1^{(1,2)} + \varepsilon^2 b_2^{(1,2)} + \mathcal{O}\left(\varepsilon^3\right), \end{aligned} \tag{E.7}$$

where

$$b_{-1}^{(1,2)} = -\tfrac{1}{6},$$

$$\begin{aligned} b_0^{(1,2)} = &-\tfrac{\alpha_0^6}{3(x\alpha_0-2\alpha_0-x)} + \tfrac{\alpha_0^5}{3(x-2)} + \tfrac{5\ \alpha_0^5}{3(x\alpha_0-2\alpha_0-x)} - \tfrac{5\alpha_0^4}{4(x-2)} + \tfrac{\alpha_0^4}{12\ (x-1)} - \tfrac{10\alpha_0^4}{3(x\alpha_0-2\alpha_0-x)} + \tfrac{5\alpha_0^4}{6\ (x-2)^2} + \\ &\tfrac{\alpha_0^4}{12} + \tfrac{5\alpha_0^3}{3(x-2)} - \tfrac{\alpha_0^3}{3\ (x-1)} + \tfrac{10\alpha_0^3}{3(x\alpha_0-2\alpha_0-x)} - \tfrac{20\alpha_0^3}{9(x-2)^2} + \tfrac{\alpha_0^3}{9(x-1)^2} + \tfrac{20\alpha_0^3}{9(x-2)^3} - \tfrac{4\alpha_0^3}{9} - \tfrac{5\alpha_0^2}{6(x-2)} + \tfrac{\alpha_0^2}{2(x-1)} - \\ &\tfrac{5\alpha_0^2}{3(x\ \alpha_0-2\alpha_0-x)} + \tfrac{5\alpha_0^2}{3(x-2)^2} - \tfrac{\alpha_0^2}{3\ (x-1)^2} - \tfrac{10\alpha_0^2}{3(x-2)^3} + \tfrac{\alpha_0^2}{6(x-1)^3} + \tfrac{20\ \alpha_0^2}{3(x-2)^4} + \alpha_0^2 - \tfrac{\alpha_0}{3(x-1)} + \tfrac{\alpha_0}{3(x\alpha_0-2\ \alpha_0-x)} + \tfrac{\alpha_0}{3(x-1)^2} - \\ &\tfrac{\alpha_0}{3(x-1)^3} + \tfrac{\alpha_0}{3\ (x-1)^4} + \tfrac{80\alpha_0}{3(x-2)^5} - \tfrac{4\alpha_0}{3} + \left(\tfrac{1}{3\ (x-1)^5} + \tfrac{1}{3} + \tfrac{80}{3(x-2)^5} + \tfrac{160}{3(x-2)^6}\right) H(0;\alpha_0) + \left(-\tfrac{1}{3(x-1)^5} + \tfrac{1}{3} - \right. \\ &\left.\tfrac{80}{3\ (x-2)^5} - \tfrac{160}{3(x-2)^6}\right) H(0;x) + \tfrac{H(c_1(\alpha_0);x)}{3\ (x-1)^5} + \left(\tfrac{80}{3(x-2)^5} + \tfrac{160}{3(x-2)^6}\right) H(c_2(\alpha_0);x) + \tfrac{80 \ln 2}{3(x-2)^5} + \tfrac{160 \ln 2}{3\ (x-2)^6} - \tfrac{11}{18}, \end{aligned}$$

$$\begin{aligned} b_1^{(1,2)} = &\tfrac{1}{\alpha_0 x-x-2\alpha_0}\Big\{ \tfrac{37x\alpha_0^5}{72} + \tfrac{31\alpha_0^5}{36(x-2)} - \tfrac{37\alpha_0^5}{72\ (x-1)} - \tfrac{\alpha_0^5}{12} - \tfrac{245x\alpha_0^4}{72} - \tfrac{5\alpha_0^4}{2\ (x-2)} + \tfrac{161\alpha_0^4}{72(x-1)} + \tfrac{65\alpha_0^4}{18(x-2)^2} - \\ &\tfrac{5\ \alpha_0^4}{6(x-1)^2} + \tfrac{11\alpha_0^4}{12} + \tfrac{91x\alpha_0^3}{9} + \tfrac{13\ \alpha_0^3}{18(x-2)} - \tfrac{125\alpha_0^3}{36(x-1)} - \tfrac{40\alpha_0^3}{9\ (x-2)^2} + \tfrac{25\alpha_0^3}{8(x-1)^2} + \tfrac{20\alpha_0^3}{(x-2)^3} - \tfrac{59\ \alpha_0^3}{36(x-1)^3} - \tfrac{307\alpha_0^3}{72} - \tfrac{61x\alpha_0^2}{3} + \tfrac{65\ \alpha_0^2}{9(x-2)} - \\ &\tfrac{\alpha_0^2}{6(x-1)} - \tfrac{43\alpha_0^2}{3\ (x-2)^2} - \tfrac{265\alpha_0^2}{72(x-1)^2} + \tfrac{400\alpha_0^2}{9\ (x-2)^3} + \tfrac{20\alpha_0^2}{3(x-1)^3} + \tfrac{1880\alpha_0^2}{9\ (x-2)^4} - \tfrac{95\alpha_0^2}{18(x-1)^4} + \tfrac{1091\ \alpha_0^2}{72} - \tfrac{1}{9}\pi^2 x\alpha_0 + \tfrac{623x\alpha_0}{54} + \\ &\tfrac{14\ \alpha_0}{9(x-2)} - \tfrac{35\alpha_0}{12(x-1)} + \tfrac{2\alpha_0}{3\ (x-2)^2} + \tfrac{61\alpha_0}{36(x-1)^2} - \tfrac{248\alpha_0}{9(x-2)^3} - \tfrac{9\ \alpha_0}{4(x-1)^3} + \tfrac{76\pi^2\alpha_0}{9(x-2)^4} - \tfrac{3760\alpha_0}{9\ (x-2)^4} + \tfrac{\pi^2\alpha_0}{9(x-1)^4} - \tfrac{95\alpha_0}{18\ (x-1)^4} + \\ &\tfrac{80\pi^2\alpha_0}{9(x-2)^5} - \tfrac{5120\alpha_0}{9\ (x-2)^5} - \tfrac{\pi^2\alpha_0}{9(x-1)^5} + \tfrac{160 \ln^2 2\, \alpha_0}{3\ (x-2)^4} + \tfrac{320 \ln^2 2\, \alpha_0}{3(x-2)^5} + \tfrac{160 \ln 2\ \ \alpha_0}{9(x-2)^4} + \tfrac{320 \ln 2\, \alpha_0}{9(x-2)^5} + \tfrac{2\pi^2\ \alpha_0}{9} + \tfrac{859\alpha_0}{108} + \tfrac{\pi^2 x}{9} + \\ &\tfrac{85x}{54} + \Big(-\tfrac{x\alpha_0^5}{3} - \tfrac{2\alpha_0^5}{3(x-2)} + \tfrac{\alpha_0^5}{3\ (x-1)} + \tfrac{19x\alpha_0^4}{9} + \tfrac{20\alpha_0^4}{9(x-2)} - \tfrac{13\ \alpha_0^4}{9(x-1)} - \tfrac{20\alpha_0^4}{9(x-2)^2} + \tfrac{4\alpha_0^4}{9(x-1)^2} - \tfrac{2\alpha_0^4}{9} - \tfrac{52x\alpha_0^3}{9} - \tfrac{20\alpha_0^3}{9\ (x-2)} + \\ &\tfrac{22\alpha_0^3}{9(x-1)} + \tfrac{40\alpha_0^3}{9(x-2)^2} - \tfrac{14\ \alpha_0^3}{9(x-1)^2} - \tfrac{80\alpha_0^3}{9(x-2)^3} + \tfrac{2\alpha_0^3}{3\ (x-1)^3} + \tfrac{4\alpha_0^3}{3} + \tfrac{28x\alpha_0^2}{3} - \tfrac{2\ \alpha_0^2}{x-1} + \tfrac{2\alpha_0^2}{(x-1)^2} - \tfrac{2\alpha_0^2}{(x-1)^3} - \tfrac{160\ \alpha_0^2}{3(x-2)^4} + \tfrac{4\alpha_0^2}{3(x-1)^4} - \\ &4\alpha_0^2 - \tfrac{11x\ \alpha_0}{2} - \tfrac{128\alpha_0}{9(x-2)} + \tfrac{31\alpha_0}{2(x-1)} + \tfrac{152\ \alpha_0}{9(x-2)^2} - \tfrac{37\alpha_0}{9(x-1)^2} - \tfrac{16\ \alpha_0}{(x-2)^3} + \tfrac{47\alpha_0}{18(x-1)^3} + \tfrac{2080\alpha_0}{9\ (x-2)^4} + \tfrac{97\alpha_0}{36(x-1)^4} + \tfrac{2240\alpha_0}{9\ (x-2)^5} - \\ &\tfrac{47\alpha_0}{18(x-1)^5} - \tfrac{37\ \alpha_0}{12} + \tfrac{x}{6} - \tfrac{88}{9(x-2)} + \tfrac{10}{x-1} + \tfrac{104}{9\ (x-2)^2} - \tfrac{25}{18(x-1)^2} - \tfrac{160}{9(x-2)^3} + \tfrac{1}{9\ (x-1)^3} - \tfrac{832}{9(x-2)^4} - \tfrac{139}{36(x-1)^4} - \\ &\tfrac{2560}{9\ (x-2)^5} - \tfrac{47}{18(x-1)^5} - \tfrac{640}{9(x-2)^6} + \tfrac{3}{4}\Big) H(0;\alpha_0) + \Big(\tfrac{x\alpha_0^5}{2} + \tfrac{\alpha_0^5}{x-2} - \tfrac{\alpha_0^5}{2\ (x-1)} - \tfrac{19x\alpha_0^4}{6} - \tfrac{10\alpha_0^4}{3(x-2)} + \tfrac{13\ \alpha_0^4}{6(x-1)} + \tfrac{10\alpha_0^4}{3(x-2)^2} - \\ &\tfrac{2\alpha_0^4}{3(x-1)^2} + \tfrac{\alpha_0^4}{3} + \tfrac{26x\alpha_0^3}{3} + \tfrac{10\alpha_0^3}{3\ (x-2)} - \tfrac{11\alpha_0^3}{3(x-1)} - \tfrac{20\alpha_0^3}{3(x-2)^2} + \tfrac{7\ \alpha_0^3}{3(x-1)^2} + \tfrac{40\alpha_0^3}{3(x-2)^3} - \tfrac{\alpha_0^3}{(x-1)^3} - 2\ \alpha_0^3 - 14x\alpha_0^2 + \tfrac{3\alpha_0^2}{x-1} - \\ &\tfrac{3\alpha_0^2}{(x-1)^2} + \tfrac{3\ \alpha_0^2}{(x-1)^3} + \tfrac{80\alpha_0^2}{(x-2)^4} - \tfrac{2\alpha_0^2}{(x-1)^4} + 6\ \alpha_0^2 + \tfrac{73x\alpha_0}{6} - \tfrac{5\alpha_0}{3(x-2)} - \tfrac{7\alpha_0}{6(x-1)} + \tfrac{20\alpha_0}{3(x-2)^2} + \tfrac{5\alpha_0}{3(x-1)^2} - \tfrac{40\ \alpha_0}{(x-2)^3} - \tfrac{3\alpha_0}{(x-1)^3} - \\ &\tfrac{320\alpha_0}{(x-2)^4} - \tfrac{320\ \alpha_0}{(x-2)^5} - \tfrac{10\alpha_0}{3} - \tfrac{25x}{6} + \tfrac{2}{3\ (x-2)} + \tfrac{1}{6(x-1)} - \tfrac{10}{3(x-2)^2} - \tfrac{1}{3\ (x-1)^2} + \tfrac{80}{3\ (x-2)^3} + \tfrac{1}{(x-1)^3} + \tfrac{240}{(x-2)^4} + \tfrac{2}{(x-1)^4} + \\ &\tfrac{320}{(x-2)^5} - 1\Big) H(1;\alpha_0) + \Big(\tfrac{2x\alpha_0}{3} + \tfrac{112\ \alpha_0}{3(x-2)^4} - \tfrac{8\alpha_0}{3(x-1)^4} + \tfrac{320\alpha_0}{3\ (x-2)^5} + \tfrac{8\alpha_0}{3(x-1)^5} - \tfrac{4\alpha_0}{3} - \tfrac{2\ x}{3} - \tfrac{112}{3(x-2)^4} + \tfrac{8}{3(x-1)^4} - \\ &\tfrac{544}{3\ (x-2)^5} + \tfrac{8}{3(x-1)^5} - \tfrac{640}{3(x-2)^6}\Big) H(0;\alpha_0)\ H(1;x) + \Big(-\tfrac{x\alpha_0^5}{6} - \tfrac{\alpha_0^5}{3(x-2)} + \tfrac{\alpha_0^5}{6\ (x-1)} + \tfrac{\alpha_0^5}{4} + \tfrac{19x\alpha_0^4}{18} + \tfrac{23\alpha_0^4}{18\ (x-2)} - \\ &\tfrac{13\alpha_0^4}{18(x-1)} - \tfrac{10\alpha_0^4}{9(x-2)^2} + \tfrac{2\ \alpha_0^4}{9(x-1)^2} - \tfrac{49\alpha_0^4}{36} - \tfrac{26x\alpha_0^3}{9} - \tfrac{16\ \alpha_0^3}{9(x-2)} + \tfrac{11\alpha_0^3}{9(x-1)} + \tfrac{26\alpha_0^3}{9\ (x-2)^2} - \tfrac{7\alpha_0^3}{9(x-1)^2} - \tfrac{40\alpha_0^3}{9\ (x-2)^3} + \tfrac{\alpha_0^3}{3(x-1)^3} + \\ &\tfrac{19\alpha_0^3}{6} + \tfrac{14x\ \alpha_0^2}{3} + \tfrac{\alpha_0^2}{x-2} - \tfrac{\alpha_0^2}{x-1} - \tfrac{2\ \alpha_0^2}{(x-2)^2} + \tfrac{\alpha_0^2}{(x-1)^2} + \tfrac{4\ \alpha_0^2}{(x-2)^3} - \tfrac{\alpha_0^2}{(x-1)^3} - \tfrac{80\alpha_0^2}{3\ (x-2)^4} + \tfrac{2\alpha_0^2}{3(x-1)^4} - \tfrac{9\alpha_0^2}{2} - \tfrac{73x\ \alpha_0}{18} - \tfrac{128\alpha_0}{9(x-2)} + \\ &\tfrac{31\alpha_0}{2(x-1)} + \tfrac{152\ \alpha_0}{9(x-2)^2} - \tfrac{37\alpha_0}{9(x-1)^2} - \tfrac{16\ \alpha_0}{(x-2)^3} + \tfrac{47\alpha_0}{18(x-1)^3} + \tfrac{144\ \alpha_0}{(x-2)^4} + \tfrac{73\alpha_0}{36(x-1)^4} + \tfrac{320\alpha_0}{3\ (x-2)^5} - \tfrac{47\alpha_0}{18(x-1)^5} + \tfrac{61\alpha_0}{36} + \tfrac{25x}{18} + \\ &\Big(-\tfrac{4\alpha_0}{3(x-1)^4} + \tfrac{4\alpha_0}{3(x-1)^5} + \tfrac{4}{3\ (x-1)^4} + \tfrac{4}{3(x-1)^5}\Big) H(0;\alpha_0) + \Big(\tfrac{2\ \alpha_0}{(x-1)^4} - \tfrac{2\ \alpha_0}{(x-1)^5} - \tfrac{2}{(x-1)^4} - \tfrac{2}{(x-1)^5}\Big)\ H(1;\alpha_0) - \end{aligned}$$

$$\frac{88}{9(x-2)}+\frac{10}{x-1}+\frac{104}{9\ (x-2)^2}-\frac{25}{18(x-1)^2}-\frac{160}{9(x-2)^3}+\frac{1}{9\ (x-1)^3}-\frac{224}{3(x-2)^4}-\frac{139}{36(x-1)^4}-\frac{640}{3\ (x-2)^5}-\frac{47}{18(x-1)^5}+$$

$$\frac{3}{4}\bigg)\ H(c_1(\alpha_0);x)+\bigg(\frac{160\alpha_0}{9(x-2)^4}+\frac{320\alpha_0}{9\ (x-2)^5}+\bigg(-\frac{320\alpha_0}{3(x-2)^4}-\frac{640\alpha_0}{3\ (x-2)^5}+\frac{320}{3(x-2)^4}+\frac{1280}{3(x-2)^5}+\frac{1280}{3\ (x-2)^6}\bigg)H(0;\alpha_0)+$$

$$\bigg(\frac{160\alpha_0}{(x-2)^4}+\frac{320\ \alpha_0}{(x-2)^5}-\frac{160}{(x-2)^4}-\frac{640}{(x-2)^5}-\frac{640}{(x-2)\ ^6}\bigg)H(1;\alpha_0)-\frac{160}{9(x-2)^4}-\frac{640}{9\ (x-2)^5}-\frac{640}{9(x-2)^6}\bigg)H(c_2(\alpha_0);x)+$$

$$\bigg(-\frac{4x\ \alpha_0}{3}-\frac{320\alpha_0}{3(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-\frac{640\ \alpha_0}{3(x-2)^5}+\frac{4\alpha_0}{3(x-1)^5}+\frac{8\alpha_0}{3}+\frac{4\ x}{3}+\frac{320}{3(x-2)^4}+\frac{4}{3(x-1)^4}+\frac{1280}{3\ (x-2)^5}+\frac{4}{3(x-1)^5}+$$

$$\frac{1280}{3(x-2)^6}\bigg)\ H(0,0;\alpha_0)+\bigg(-\frac{4x\alpha_0}{3}+\frac{320\alpha_0}{3(x-2)^4}+\frac{4\ \alpha_0}{3(x-1)^4}+\frac{640\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3\ (x-1)^5}+\frac{8\alpha_0}{3}+\frac{4x}{3}-\frac{320}{3\ (x-2)^4}-\frac{4}{3(x-1)^4}-$$

$$\frac{1280}{3(x-2)^5}-\frac{4}{3\ (x-1)^5}-\frac{1280}{3(x-2)^6}\bigg)H(0,0;x)+\bigg(2x\alpha_0+\frac{160\ \alpha_0}{(x-2)^4}+\frac{2\alpha_0}{(x-1)^4}+\frac{320\alpha_0}{(x-2)^5}-\frac{2\ \alpha_0}{(x-1)^5}-4\alpha_0-2\ x-$$

$$\frac{160}{(x-2)^4}-\frac{2}{(x-1)^4}-\frac{640}{(x-2)^5}-\frac{2}{(\ x-1)^5}-\frac{640}{(x-2)^6}\bigg)H(0,1;\alpha_0)+\bigg(\frac{2x\ \alpha_0}{3}+\frac{112\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{320\ \alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-$$

$$\frac{4\alpha_0}{3}-\frac{2\ x}{3}-\frac{112}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{544}{3\ (x-2)^5}+\frac{2}{3(x-1)^5}-\frac{640}{3(x-2)^6}\bigg)\ H(0,c_1(\alpha_0);x)+\bigg(-\frac{320\alpha_0}{3(x-2)^4}-\frac{640\alpha_0}{3\ (x-2)^5}+$$

$$\frac{320}{3(x-2)^4}+\frac{1280}{3(x-2)^5}+\frac{1280}{3\ (x-2)^6}\bigg)H(0,c_2(\alpha_0);x)+\bigg(-\frac{2x\alpha_0}{3}-\frac{112\ \alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{320\alpha_0}{3\ (x-2)^5}-\frac{8\alpha_0}{3(x-1)^5}+$$

$$\frac{4\alpha_0}{3}+\frac{2\ x}{3}+\frac{112}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{544}{3\ (x-2)^5}-\frac{8}{3(x-1)^5}+\frac{640}{3(x-2)^6}\bigg)\ H(1,0;x)+\bigg(\frac{2x\alpha_0}{3}+\frac{112\alpha_0}{3(x-2)^4}-\frac{8\ \alpha_0}{3(x-1)^4}+$$

$$\frac{320\alpha_0}{3(x-2)^5}+\frac{8\alpha_0}{3\ (x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{112}{3\ (x-2)^4}+\frac{8}{3(x-1)^4}-\frac{544}{3(x-2)^5}+\frac{8}{3\ (x-1)^5}-\frac{640}{3(x-2)^6}\bigg)H(1,c_1(\alpha_0);x)+\bigg(-$$

$$\frac{800\ \alpha_0}{3(x-2)^4}-\frac{1600\alpha_0}{3(x-2)^5}+\frac{800}{3\ (x-2)^4}+\frac{3200}{3(x-2)^5}+\frac{3200}{3(x-2)^6}\bigg)H(2,0;x)+\ \bigg(\frac{800\alpha_0}{3(x-2)^4}+\frac{1600\alpha_0}{3\ (x-2)^5}-\frac{800}{3(x-2)^4}-\frac{3200}{3(x-2)^5}-$$

$$\frac{3200}{3\ (x-2)^6}\bigg)H(2,c_2(\alpha_0);x)+\bigg(-\frac{2\alpha_0}{3(x-1)^4}+\frac{2\ \alpha_0}{3(x-1)^5}+\frac{2}{3(x-1)^4}+\frac{2}{3(x-1)^5}\bigg)\ H(c_1(\alpha_0),c_1(\alpha_0);x)+\bigg(-$$

$$\frac{112\alpha_0}{3(x-2)^4}-\frac{320\ \alpha_0}{3(x-2)^5}+\frac{112}{3(x-2)^4}+\frac{544}{3\ (x-2)^5}+\frac{640}{3(x-2)^6}\bigg)H(c_2(\alpha_0),c_1(\alpha_0);x)+H(0;x)\ \bigg(\frac{47x\alpha_0}{18}+\frac{128\alpha_0}{9(x-2)}-$$

$$\frac{31\alpha_0}{2\ (x-1)}-\frac{152\alpha_0}{9(x-2)^2}+\frac{37\alpha_0}{9(x-1)^2}+\frac{16\ \alpha_0}{(x-2)^3}-\frac{47\alpha_0}{18(x-1)^3}-\frac{1120\alpha_0}{9\ (x-2)^4}-\frac{49\alpha_0}{36(x-1)^4}-\frac{320\alpha_0}{9(x-2)^5}+\frac{47\ \alpha_0}{18(x-1)^5}-\frac{320\ln 2\,\alpha_0}{3(x-2)^4}-$$

$$\frac{640\ln 2\ \ \alpha_0}{3(x-2)^5}-\frac{161\alpha_0}{36}-\frac{47x}{18}+\frac{88}{9\ (x-2)}-\frac{10}{x-1}-\frac{104}{9(x-2)^2}+\frac{25}{18\ (x-1)^2}+\frac{160}{9(x-2)^3}-\frac{1}{9(x-1)^3}+\frac{832}{9\ (x-2)^4}+\frac{139}{36(x-1)^4}+$$

$$\frac{2560}{9(x-2)^5}+\frac{47}{18\ (x-1)^5}+\frac{640}{9(x-2)^6}+\frac{320\ln 2}{3\ (x-2)^4}+\frac{1280\ln 2}{3(x-2)^5}+\frac{1280\ln 2}{3\ (x-2)^6}-\frac{3}{4}\bigg)+H(2;x)\bigg(\frac{800\ln 2\,\alpha_0}{3\ (x-2)^4}+\frac{1600\ln 2\,\alpha_0}{3(x-2)^5}+$$

$$\bigg(\frac{800\alpha_0}{3\ (x-2)^4}+\frac{1600\alpha_0}{3(x-2)^5}-\frac{800}{3\ (x-2)^4}-\frac{3200}{3(x-2)^5}-\frac{3200}{3(x-2)^6}\bigg)H(0;\alpha_0)-\frac{800\ln 2}{3(x-2)^4}-\frac{3200\ln 2}{3\ (x-2)^5}-\frac{3200\ln 2}{3(x-2)^6}\bigg)-\frac{76\pi^2}{9\ (x-2)^4}-$$

$$\frac{\pi^2}{9(x-1)^4}-\frac{232\pi^2}{9(x-2)^5}-\frac{\pi^2}{9(x-1)^5}-\frac{160\pi^2}{9(x-2)^6}-\frac{160\ln^2 2}{3(x-2)^4}-\frac{640\ln^2 2}{3(x-2)^5}-\frac{640\ln^2 2}{3\ (x-2)^6}-\frac{160\ln 2}{9(x-2)^4}-\frac{640\ln 2}{9\ (x-2)^5}-\frac{640\ln 2}{9(x-2)^6}\Big\},$$

$$b_2^{(1,2)}=\frac{1}{\alpha_0 x-x-2\alpha_0}\bigg\{-\frac{1}{72}\pi^2 x\alpha_0^5+\frac{895x\alpha_0^5}{432}-\frac{\pi^2\ \alpha_0^5}{36(x-2)}+\frac{673\alpha_0^5}{216(x-2)}+\frac{\pi^2\alpha_0^5}{72\ (x-1)}-\frac{895\alpha_0^5}{432(x-1)}-\frac{37\alpha_0^5}{72}+$$

$$\frac{19}{216}\ \pi^2 x\alpha_0^4-\frac{18829x\alpha_0^4}{1296}+\frac{5\pi^2\alpha_0^4}{54\ (x-2)}-\frac{2345\alpha_0^4}{324(x-2)}-\frac{13\pi^2\alpha_0^4}{216\ (x-1)}+\frac{12073\alpha_0^4}{1296(x-1)}-\frac{5\pi^2\alpha_0^4}{54\ (x-2)^2}+\frac{5405\alpha_0^4}{324(x-2)^2}+\frac{\pi^2\alpha_0^4}{54\ (x-1)^2}-$$

$$\frac{1351\alpha_0^4}{324(x-1)^2}-\frac{\pi^2\ \alpha_0^4}{108}+\frac{3691\alpha_0^4}{648}-\frac{13}{54}\pi^2 x\ \alpha_0^3+\frac{7859x\alpha_0^3}{162}-\frac{5\pi^2\alpha_0^3}{54\ (x-2)}-\frac{3451\alpha_0^3}{324(x-2)}+\frac{11\pi^2\alpha_0^3}{108\ (x-1)}-\frac{7985\alpha_0^3}{648(x-1)}+\frac{5\pi^2\alpha_0^3}{27\ (x-2)^2}-$$

$$\frac{115\alpha_0^3}{81(x-2)^2}-\frac{7\pi^2\alpha_0^3}{108\ (x-1)^2}+\frac{22919\alpha_0^3}{1296(x-1)^2}-\frac{10\pi^2\alpha_0^3}{27\ (x-2)^3}+\frac{10580\alpha_0^3}{81(x-2)^3}+\frac{\pi^2\alpha_0^3}{36\ (x-1)^3}-\frac{2401\alpha_0^3}{216(x-1)^3}+\frac{\pi^2\ \alpha_0^3}{18}-\frac{12859\alpha_0^3}{432}+$$

$$\frac{7}{18}\pi^2 x\ \alpha_0^2-\frac{7613x\alpha_0^2}{54}+\frac{211\alpha_0^2}{2(x-2)}-\frac{\pi^2\ \alpha_0^2}{12(x-1)}-\frac{823\alpha_0^2}{18(x-1)}-\frac{3931\alpha_0^2}{18\ (x-2)^2}+\frac{\pi^2\alpha_0^2}{12(x-1)^2}-\frac{685\alpha_0^2}{48\ (x-1)^2}+\frac{7600\alpha_0^2}{9(x-2)^3}-\frac{\pi^2\alpha_0^2}{12\ (x-1)^3}+$$

$$\frac{2507\alpha_0^2}{36(x-1)^3}-\frac{20\pi^2\alpha_0^2}{9\ (x-2)^4}+\frac{66760\alpha_0^2}{27(x-2)^4}+\frac{\pi^2\alpha_0^2}{18\ (x-1)^4}-\frac{6685\alpha_0^2}{108(x-1)^4}-\frac{\pi^2\ \alpha_0^2}{6}+\frac{22817\alpha_0^2}{144}-\frac{29}{24}\pi^2 x\ \alpha_0+\frac{16423x\alpha_0}{162}-\frac{10\pi^2\alpha_0}{9(x-2)}+$$

$$\frac{65\ \alpha_0}{3(x-2)}+\frac{409\pi^2\alpha_0}{216(x-1)}-\frac{3017\alpha_0}{72\ (x-1)}+\frac{2\pi^2\alpha_0}{3(x-2)^2}+\frac{13\alpha_0}{(x-2)^2}-\frac{4\ \pi^2\alpha_0}{9(x-1)^2}+\frac{1715\alpha_0}{72(x-1)^2}+\frac{8\pi^2\ \alpha_0}{3(x-2)^3}-\frac{4936\alpha_0}{9(x-2)^3}+\frac{55\pi^2\alpha_0}{108\ (x-1)^3}-$$

$$\frac{1033\alpha_0}{24(x-1)^3}+\frac{1136\pi^2\alpha_0}{27\ (x-2)^4}-\frac{133520\alpha_0}{27(x-2)^4}+\frac{55\pi^2\alpha_0}{108\ (x-1)^4}-\frac{6685\alpha_0}{108(x-1)^4}+\frac{400\pi^2\alpha_0}{27\ (x-2)^5}-\frac{154240\alpha_0}{27(x-2)^5}-\frac{47\pi^2\alpha_0}{54\ (x-1)^5}+\frac{17}{12}x\zeta_3\alpha_0+$$

$$\frac{56\zeta_3\alpha_0}{3\ (x-2)^4}-\frac{7\zeta_3\alpha_0}{4(x-1)^4}+\frac{280\zeta_3\alpha_0}{3\ (x-2)^5}+\frac{7\zeta_3\alpha_0}{4(x-1)^5}-\frac{17}{6}\zeta_3\ \alpha_0+\frac{640\ln^3 2\,\alpha_0}{9(x-2)^4}+\frac{1280\ln^3 2\,\alpha_0}{9\ (x-2)^5}+\frac{320\ln^2 2\,\alpha_0}{9(x-2)^4}+\frac{640\ln^2 2\ \ \alpha_0}{9(x-2)^5}-$$

$$\frac{1}{6}\pi^2 x\ln 2\,\alpha_0+\frac{112\pi^2\ \ln 2\,\alpha_0}{3(x-2)^4}+\frac{320\ln 2\,\alpha_0}{27\ (x-2)^4}+\frac{\pi^2\ln 2\,\alpha_0}{6(x-1)^4}+\frac{80\pi^2\ln\ \ 2\,\alpha_0}{3(x-2)^5}+\frac{640\ln 2\,\alpha_0}{27(x-2)^5}-\frac{\pi^2\ \ln 2\,\alpha_0}{6(x-1)^5}+\frac{1}{3}\pi^2\ln 2\,\alpha_0+$$

$$\frac{95\pi\ ^2\alpha_0}{72}+\frac{20569\alpha_0}{648}+\frac{71\pi^2 x}{72}+\frac{575\ x}{162}+\bigg(-\frac{37x\alpha_0^5}{18}-\frac{31\alpha_0^5}{9(x-2)}+\frac{37\ \alpha_0^5}{18(x-1)}+\frac{\alpha_0^5}{3}+\frac{245x\alpha_0^4}{18}+\frac{10\ \alpha_0^4}{x-2}-\frac{161\alpha_0^4}{18(x-1)}-\frac{130\alpha_0^4}{9\ (x-2)^2}+$$

$$\frac{10\alpha_0^4}{3(x-1)^2}-\frac{11\alpha_0^4}{3}-\frac{364x\ \alpha_0^3}{9}-\frac{26\alpha_0^3}{9(x-2)}+\frac{125\alpha_0^3}{9\ (x-1)}+\frac{160\alpha_0^3}{9(x-2)^2}-\frac{25\alpha_0^3}{2\ (x-1)^2}-\frac{80\alpha_0^3}{(x-2)^3}+\frac{59\alpha_0^3}{9\ (x-1)^3}+\frac{307\alpha_0^3}{18}+\frac{244x\alpha_0^2}{3}-$$

$$\frac{260\ \alpha_0^2}{9(x-2)}+\frac{2\alpha_0^2}{3(x-1)}+\frac{172\alpha_0^2}{3\ (x-2)^2}+\frac{265\alpha_0^2}{18(x-1)^2}-\frac{1600\alpha_0^2}{9\ (x-2)^3}-\frac{80\alpha_0^2}{3(x-1)^3}-\frac{7520\alpha_0^2}{9\ (x-2)^4}+\frac{190\alpha_0^2}{9(x-1)^4}-\frac{1091\ \alpha_0^2}{18}-\frac{1}{18}\pi^2 x\alpha_0-$$

$$\frac{7109x\alpha_0}{108} - \frac{1804\alpha_0}{9(x-2)} + \frac{2002\alpha_0}{9(x-1)} + \frac{1936\alpha_0}{9(x-2)^2} - \frac{413\alpha_0}{9(x-1)^2} - \frac{496\alpha_0}{9(x-2)^3} + \frac{227\alpha_0}{6(x-1)^3} - \frac{40\pi^2\alpha_0}{9(x-2)^4} + \frac{76160\alpha_0}{27(x-2)^4} - \frac{\pi^2\alpha_0}{18(x-1)^4} +$$

$$\frac{5381\alpha_0}{216(x-1)^4} - \frac{80\pi^2\alpha_0}{9(x-2)^5} + \frac{62080\alpha_0}{27(x-2)^5} + \frac{\pi^2\alpha_0}{18(x-1)^5} - \frac{2125\alpha_0}{108(x-1)^5} + \frac{\pi^2\alpha_0}{9} - \frac{811\alpha_0}{216} + \frac{\pi^2 x}{18} + \frac{1445x}{108} - \frac{1372}{9(x-2)} + \frac{5705}{36(x-1)} +$$

$$\frac{512}{3(x-2)^2} - \frac{475}{36(x-1)^2} - \frac{2432}{9(x-2)^3} - \frac{35}{12(x-1)^3} + \frac{40\pi^2}{9(x-2)^4} - \frac{22112}{27(x-2)^4} + \frac{\pi^2}{18(x-1)^4} - \frac{7679}{216(x-1)^4} + \frac{160\pi^2}{9(x-2)^5} -$$

$$\frac{62720}{27(x-2)^5} + \frac{\pi^2}{18(x-1)^5} - \frac{2125}{108(x-1)^5} + \frac{160\pi^2}{9(x-2)^6} - \frac{1280}{27(x-2)^6} + \frac{271}{24}\Big) H(0;\alpha_0) + \Big(\frac{37x\alpha_0^5}{12} + \frac{31\alpha_0^5}{6(x-2)} - \frac{37\alpha_0^5}{12(x-1)} -$$

$$\frac{\alpha_0^5}{2} - \frac{245x\alpha_0^4}{12} - \frac{15\alpha_0^4}{x-2} + \frac{161\alpha_0^4}{12(x-1)} + \frac{65\alpha_0^4}{3(x-2)^2} - \frac{5\alpha_0^4}{(x-1)^2} + \frac{11\alpha_0^4}{2} + \frac{182x\alpha_0^3}{3} + \frac{13\alpha_0^3}{3(x-2)} - \frac{125\alpha_0^3}{6(x-1)} - \frac{80\alpha_0^3}{3(x-2)^2} + \frac{75\alpha_0^3}{4(x-1)^2} +$$

$$\frac{120\alpha_0^3}{(x-2)^3} - \frac{59\alpha_0^3}{6(x-1)^3} - \frac{307\alpha_0^3}{12} - 122x\alpha_0^2 + \frac{130\alpha_0^2}{3(x-2)} - \frac{\alpha_0^2}{x-1} - \frac{86\alpha_0^2}{(x-2)^2} - \frac{265\alpha_0^2}{12(x-1)^2} + \frac{800\alpha_0^2}{3(x-2)^3} + \frac{40\alpha_0^2}{(x-1)^3} + \frac{3760\alpha_0^2}{3(x-2)^4} -$$

$$\frac{95\alpha_0^2}{3(x-1)^4} + \frac{1091\alpha_0^2}{12} + \frac{513x\alpha_0}{4} - \frac{205\alpha_0}{6(x-2)} - \frac{25\alpha_0}{12(x-1)} + \frac{344\alpha_0}{3(x-2)^2} + \frac{211\alpha_0}{12(x-1)^2} - \frac{792\alpha_0}{(x-2)^3} - \frac{107\alpha_0}{2(x-1)^3} - \frac{12640\alpha_0}{3(x-2)^4} - \frac{10240\alpha_0}{3(x-2)^5} -$$

$$\frac{245\alpha_0}{4} - \frac{595x}{12} - \frac{11}{3(x-2)} + \frac{163}{12(x-1)} - \frac{71}{3(x-2)^2} - \frac{37}{4(x-1)^2} + \frac{1216}{3(x-2)^3} + \frac{70}{3(x-1)^3} + \frac{2960}{(x-2)^4} + \frac{95}{3(x-1)^4} + \frac{10240}{3(x-2)^5} -$$

$$\frac{109}{12}\Big) H(1;\alpha_0) + \Big(\frac{4x\alpha_0^5}{3} + \frac{8\alpha_0^5}{3(x-2)} - \frac{4\alpha_0^5}{3(x-1)} - \frac{76x\alpha_0^4}{9} - \frac{80\alpha_0^4}{9(x-2)} + \frac{52\alpha_0^4}{9(x-1)} + \frac{80\alpha_0^4}{9(x-2)^2} - \frac{16\alpha_0^4}{9(x-1)^2} + \frac{8\alpha_0^4}{9} + \frac{208x\alpha_0^3}{9} +$$

$$\frac{80\alpha_0^3}{9(x-2)} - \frac{88\alpha_0^3}{9(x-1)} - \frac{160\alpha_0^3}{9(x-2)^2} + \frac{56\alpha_0^3}{9(x-1)^2} + \frac{320\alpha_0^3}{9(x-2)^3} - \frac{8\alpha_0^3}{3(x-1)^3} - \frac{16\alpha_0^3}{3} - \frac{112x\alpha_0^2}{3} + \frac{8\alpha_0^2}{x-1} - \frac{8\alpha_0^2}{(x-1)^2} + \frac{8\alpha_0^2}{(x-1)^3} + \frac{640\alpha_0^2}{3(x-2)^4} -$$

$$\frac{16\alpha_0^2}{3(x-1)^4} + 16\alpha_0^2 + 22x\alpha_0 + \frac{512\alpha_0}{9(x-2)} - \frac{62\alpha_0}{x-1} - \frac{608\alpha_0}{9(x-2)^2} + \frac{148\alpha_0}{9(x-1)^2} + \frac{64\alpha_0}{(x-2)^3} - \frac{94\alpha_0}{9(x-1)^3} - \frac{8320\alpha_0}{9(x-2)^4} - \frac{97\alpha_0}{9(x-1)^4} -$$

$$\frac{8960\alpha_0}{9(x-2)^5} + \frac{94\alpha_0}{9(x-1)^5} + \frac{37\alpha_0}{3} - \frac{2x}{3} + \frac{352}{9(x-2)} - \frac{40}{x-1} - \frac{416}{9(x-2)^2} + \frac{50}{9(x-1)^2} + \frac{640}{9(x-2)^3} - \frac{4}{9(x-1)^3} + \frac{3328}{9(x-2)^4} + \frac{139}{9(x-1)^4} +$$

$$\frac{10240}{9(x-2)^5} + \frac{94}{9(x-1)^5} + \frac{2560}{9(x-2)^6} - 3\Big) H(0,0;\alpha_0) + \Big(-2x\alpha_0^5 - \frac{4\alpha_0^5}{x-2} + \frac{2\alpha_0^5}{x-1} + \frac{38x\alpha_0^4}{3} + \frac{40\alpha_0^4}{3(x-2)} - \frac{26\alpha_0^4}{3(x-1)} - \frac{40\alpha_0^4}{3(x-2)^2} +$$

$$\frac{8\alpha_0^4}{3(x-1)^2} - \frac{4\alpha_0^4}{3} - \frac{104x\alpha_0^3}{3} - \frac{40\alpha_0^3}{3(x-2)} + \frac{44\alpha_0^3}{3(x-1)} + \frac{80\alpha_0^3}{3(x-2)^2} - \frac{28\alpha_0^3}{3(x-1)^2} - \frac{160\alpha_0^3}{3(x-2)^3} + \frac{4\alpha_0^3}{(x-1)^3} + 8\alpha_0^3 + 56x\alpha_0^2 - \frac{12\alpha_0^2}{x-1} +$$

$$\frac{12\alpha_0^2}{(x-1)^2} - \frac{12\alpha_0^2}{(x-1)^3} - \frac{320\alpha_0^2}{(x-2)^4} + \frac{8\alpha_0^2}{(x-1)^4} - 24\alpha_0^2 - 33x\alpha_0 - \frac{256\alpha_0}{3(x-2)} + \frac{93\alpha_0}{x-1} + \frac{304\alpha_0}{3(x-2)^2} - \frac{74\alpha_0}{3(x-1)^2} - \frac{96\alpha_0}{(x-2)^3} + \frac{47\alpha_0}{3(x-1)^3} +$$

$$\frac{4160\alpha_0}{3(x-2)^4} + \frac{97\alpha_0}{6(x-1)^4} + \frac{4480\alpha_0}{3(x-2)^5} - \frac{47\alpha_0}{3(x-1)^5} - \frac{37\alpha_0}{2} + x - \frac{176}{3(x-2)} + \frac{60}{x-1} + \frac{208}{3(x-2)^2} - \frac{25}{3(x-1)^2} - \frac{320}{3(x-2)^3} + \frac{2}{3(x-1)^3} -$$

$$\frac{1664}{3(x-2)^4} - \frac{139}{6(x-1)^4} - \frac{5120}{3(x-2)^5} - \frac{47}{3(x-1)^5} - \frac{1280}{3(x-2)^6} + \frac{9}{2}\Big) H(0,1;\alpha_0) + H(1;x)\Big(\frac{1}{9}\pi^2 x\alpha_0 + \frac{16\pi^2\alpha_0}{(x-2)^4} - \frac{8\pi^2\alpha_0}{9(x-1)^4} +$$

$$\frac{80\pi^2\alpha_0}{3(x-2)^5} + \frac{8\pi^2\alpha_0}{9(x-1)^5} - \frac{2\pi^2\alpha_0}{9} - \frac{\pi^2 x}{9} + \Big(\frac{47x\alpha_0}{9} + \frac{838\alpha_0}{9(x-2)} - \frac{102\alpha_0}{x-1} - \frac{1000\alpha_0}{9(x-2)^2} + \frac{433\alpha_0}{18(x-1)^2} + \frac{128\alpha_0}{(x-2)^3} - \frac{113\alpha_0}{9(x-1)^3} -$$

$$\frac{4288\alpha_0}{9(x-2)^4} - \frac{137\alpha_0}{9(x-1)^4} + \frac{640\alpha_0}{9(x-2)^5} + \frac{188\alpha_0}{9(x-1)^5} - \frac{77\alpha_0}{18} - \frac{47x}{9} + \frac{578}{9(x-2)} - \frac{203}{3(x-1)} - \frac{676}{9(x-2)^2} + \frac{185}{18(x-1)^2} + \frac{848}{9(x-2)^3} -$$

$$\frac{11}{9(x-1)^3} + \frac{1984}{9(x-2)^4} + \frac{239}{9(x-1)^4} + \frac{7936}{9(x-2)^5} + \frac{188}{9(x-1)^5} - \frac{1280}{9(x-2)^6} - \frac{37}{6}\Big) H(0;\alpha_0) + \Big(-\frac{8x\alpha_0}{3} - \frac{448\alpha_0}{3(x-2)^4} + \frac{32\alpha_0}{3(x-1)^4} -$$

$$\frac{1280\alpha_0}{3(x-2)^5} - \frac{32\alpha_0}{3(x-1)^5} + \frac{16\alpha_0}{3} + \frac{8x}{3} + \frac{448}{3(x-2)^4} - \frac{32}{3(x-1)^4} + \frac{2176}{3(x-2)^5} - \frac{32}{3(x-1)^5} + \frac{2560}{3(x-2)^6}\Big) H(0,0;\alpha_0) + \Big(4x\alpha_0 +$$

$$\frac{224\alpha_0}{(x-2)^4} - \frac{16\alpha_0}{(x-1)^4} + \frac{640\alpha_0}{(x-2)^5} + \frac{16\alpha_0}{(x-1)^5} - 8\alpha_0 - 4x - \frac{224}{(x-2)^4} + \frac{16}{(x-1)^4} - \frac{1088}{(x-2)^5} + \frac{16}{(x-1)^5} - \frac{1280}{(x-2)^6}\Big) H(0,1;\alpha_0) -$$

$$\frac{16\pi^2}{(x-2)^4} + \frac{8\pi^2}{9(x-1)^4} - \frac{176\pi^2}{3(x-2)^5} + \frac{8\pi^2}{9(x-1)^5} - \frac{160\pi^2}{3(x-2)^6}\Big) + \Big(-\frac{20x\alpha_0}{3} - \frac{1216\alpha_0}{3(x-2)^4} + \frac{20\alpha_0}{3(x-1)^4} - \frac{3200\alpha_0}{3(x-2)^5} - \frac{20\alpha_0}{3(x-1)^5} +$$

$$\frac{40\alpha_0}{3} + \frac{20x}{3} + \frac{1216}{3(x-2)^4} - \frac{20}{3(x-1)^4} + \frac{5632}{3(x-2)^5} - \frac{20}{3(x-1)^5} + \frac{6400}{3(x-2)^6}\Big) H(0;\alpha_0)\, H(0,1;x) + \Big(\frac{\alpha_0^5}{2} + \frac{\alpha_0^4}{3(x-2)} - \frac{5\alpha_0^4}{2} -$$

$$\frac{4\alpha_0^3}{3(x-2)} + \frac{4\alpha_0^3}{3(x-2)^2} + 5\alpha_0^3 + \frac{2\alpha_0^2}{x-2} - \frac{4\alpha_0^2}{(x-2)^2} + \frac{8\alpha_0^2}{(x-2)^3} - 5\alpha_0^2 + \frac{47x\alpha_0}{9} + \frac{64\alpha_0}{9(x-2)} - \frac{34\alpha_0}{3(x-1)} - \frac{40\alpha_0}{9(x-2)^2} + \frac{49\alpha_0}{18(x-1)^2} -$$

$$\frac{16\alpha_0}{(x-2)^3} - \frac{26\alpha_0}{9(x-1)^3} - \frac{1696\alpha_0}{9(x-2)^4} - \frac{55\alpha_0}{18(x-1)^4} + \frac{640\alpha_0}{9(x-2)^5} + \frac{47\alpha_0}{9(x-1)^5} - \frac{52\alpha_0}{9} - \frac{47x}{9} + \Big(-\frac{8x\alpha_0}{3} - \frac{448\alpha_0}{3(x-2)^4} + \frac{8\alpha_0}{3(x-1)^4} -$$

$$\frac{1280\alpha_0}{3(x-2)^5} - \frac{8\alpha_0}{3(x-1)^5} + \frac{16\alpha_0}{3} + \frac{8x}{3} + \frac{448}{3(x-2)^4} - \frac{8}{3(x-1)^4} + \frac{2176}{3(x-2)^5} - \frac{8}{3(x-1)^5} + \frac{2560}{3(x-2)^6}\Big) H(0;\alpha_0) + \Big(4x\alpha_0 +$$

$$\frac{224\alpha_0}{(x-2)^4} - \frac{4\alpha_0}{(x-1)^4} + \frac{640\alpha_0}{(x-2)^5} + \frac{4\alpha_0}{(x-1)^5} - 8\alpha_0 - 4x - \frac{224}{(x-2)^4} + \frac{4}{(x-1)^4} - \frac{1088}{(x-2)^5} + \frac{4}{(x-1)^5} - \frac{1280}{(x-2)^6}\Big) H(1;\alpha_0) +$$

$$\frac{56}{9(x-2)} - \frac{22}{3(x-1)} - \frac{88}{9(x-2)^2} + \frac{23}{18(x-1)^2} + \frac{224}{9(x-2)^3} + \frac{13}{9(x-1)^3} + \frac{1696}{9(x-2)^4} + \frac{133}{18(x-1)^4} + \frac{2176}{9(x-2)^5} + \frac{47}{9(x-1)^5} -$$

$$\frac{1280}{9(x-2)^6} - \frac{8}{3}\Big) H(0,c_1(\alpha_0);x) + \Big(-\frac{640\alpha_0}{9(x-2)^4} - \frac{1280\alpha_0}{9(x-2)^5} + \Big(\frac{1280\alpha_0}{3(x-2)^4} + \frac{2560\alpha_0}{3(x-2)^5} - \frac{1280}{3(x-2)^4} - \frac{5120}{3(x-2)^5} -$$

$$\frac{5120}{3(x-2)^6}\Big) H(0;\alpha_0) + \Big(-\frac{640\alpha_0}{(x-2)^4} - \frac{1280\alpha_0}{(x-2)^5} + \frac{640}{(x-2)^4} + \frac{2560}{(x-2)^5} + \frac{2560}{(x-2)^6}\Big) H(1;\alpha_0) + \frac{640}{9(x-2)^4} + \frac{2560}{9(x-2)^5} +$$

$$\frac{2560}{9(x-2)^6}\Big) H(0,c_2(\alpha_0);x) + \Big(-2x\alpha_0^5 - \frac{4\alpha_0^5}{x-2} + \frac{2\alpha_0^5}{x-1} + \frac{38x\alpha_0^4}{3} + \frac{40\alpha_0^4}{3(x-2)} - \frac{26\alpha_0^4}{3(x-1)} - \frac{40\alpha_0^4}{3(x-2)^2} + \frac{8\alpha_0^4}{3(x-1)^2} - \frac{4\alpha_0^4}{3} -$$

$$\frac{104x\,\alpha_0^3}{3}-\frac{40\alpha_0^3}{3(x-2)}+\frac{44\alpha_0^3}{3(x-1)}+\frac{80\,\alpha_0^3}{3(x-2)^2}-\frac{28\alpha_0^3}{3(x-1)^2}-\frac{160\alpha_0^3}{3\,(x-2)^3}+\frac{4\alpha_0^3}{(x-1)^3}+8\alpha_0^3+56x\alpha_0^2-\frac{12\,\alpha_0^2}{x-1}+\frac{12\alpha_0^2}{(x-1)^2}-\frac{12\,\alpha_0^2}{(x-1)^3}-$$

$$\frac{320\alpha_0^2}{(x-2)^4}+\frac{8\alpha_0^2}{(x-1)^4}-24\,\alpha_0^2-\frac{146x\alpha_0}{3}+\frac{20\alpha_0}{3(x-2)}+\frac{14\alpha_0}{3\,(x-1)}-\frac{80\alpha_0}{3(x-2)^2}-\frac{20\alpha_0}{3(x-1)^2}+\frac{160\,\alpha_0}{(x-2)^3}+\frac{12\alpha_0}{(x-1)^3}+\frac{1280\,\alpha_0}{(x-2)^4}+$$

$$\frac{1280\alpha_0}{(x-2)^5}+\frac{40\alpha_0}{3}+\frac{50\,x}{3}-\frac{8}{3(x-2)}-\frac{2}{3(x-1)}+\frac{40}{3\,(x-2)^2}+\frac{4}{3(x-1)^2}-\frac{320}{3(x-2)^3}-\frac{4}{(x-1)^3}-\frac{960}{(x-2)^4}-\frac{8}{(x-1)^4}-\frac{1280}{(x-2)^5}+$$

$$4\Big)H(1,0;\alpha_0)+\Big(-\frac{47x\alpha_0}{9}-\frac{838\alpha_0}{9(x-2)}+\frac{102\,\alpha_0}{x-1}+\frac{1000\alpha_0}{9(x-2)^2}-\frac{433\alpha_0}{18\,(x-1)^2}-\frac{128\alpha_0}{(x-2)^3}+\frac{113\alpha_0}{9(x-1)^3}+\frac{4288\,\alpha_0}{9(x-2)^4}+\frac{137\alpha_0}{9(x-1)^4}-$$

$$\frac{640\alpha_0}{9\,(x-2)^5}-\frac{188\alpha_0}{9(x-1)^5}+\frac{77\alpha_0}{18}+\frac{47\,x}{9}-\frac{578}{9(x-2)}+\frac{203}{3(x-1)}+\frac{676}{9\,(x-2)^2}-\frac{185}{18(x-1)^2}-\frac{848}{9(x-2)^3}+\frac{11}{9\,(x-1)^3}-\frac{1984}{9(x-2)^4}-$$

$$\frac{239}{9(x-1)^4}-\frac{7936}{9\,(x-2)^5}-\frac{188}{9(x-1)^5}+\frac{1280}{9\,(x-2)^6}+\frac{37}{6}\Big)H(1,0;x)+\Big(3x\alpha_0^5+\frac{6\,\alpha_0^5}{x-2}-\frac{3\alpha_0^5}{x-1}-19x\alpha_0^4-\frac{20\,\alpha_0^4}{x-2}+\frac{13\alpha_0^4}{x-1}+$$

$$\frac{20\alpha_0^4}{(x-2)^2}-\frac{4\,\alpha_0^4}{(x-1)^2}+2\alpha_0^4+52x\alpha_0^3+\frac{20\alpha_0^3}{x-2}-\frac{22\,\alpha_0^3}{x-1}-\frac{40\alpha_0^3}{(x-2)^2}+\frac{14\,\alpha_0^3}{(x-1)^2}+\frac{80\alpha_0^3}{(x-2)^3}-\frac{6\alpha_0^3}{(x-1)^3}-12\,\alpha_0^3-84x\alpha_0^2+\frac{18\alpha_0^2}{x-1}-$$

$$\frac{18\,\alpha_0^2}{(x-1)^2}+\frac{18\alpha_0^2}{(x-1)^3}+\frac{480\,\alpha_0^2}{(x-2)^4}-\frac{12\alpha_0^2}{(x-1)^4}+36\alpha_0^2+73x\alpha_0-\frac{10\,\alpha_0}{x-2}-\frac{7\alpha_0}{x-1}+\frac{40\alpha_0}{(x-2)^2}+\frac{10\,\alpha_0}{(x-1)^2}-\frac{240\alpha_0}{(x-2)^3}-\frac{18\,\alpha_0}{(x-1)^3}-$$

$$\frac{1920\alpha_0}{(x-2)^4}-\frac{1920\alpha_0}{(x-2)^5}-20\,\alpha_0-25x+\frac{4}{x-2}+\frac{1}{x-1}-\frac{20}{(x-2)^2}-\frac{2}{(x-1)^2}+\frac{160}{(x-2)^3}+\frac{6}{(x-1)^3}+\frac{1440}{(x-2)^4}+\frac{12}{(x-1)^4}+\frac{1920}{(x-2)^5}-$$

$$6\Big)H(1,1;\alpha_0)+H(c_2(\alpha_0);x)\Big(-\frac{40\pi^2\alpha_0}{9(x-2)^4}+\frac{320\alpha_0}{27\,(x-2)^4}-\frac{80\pi^2\alpha_0}{9(x-2)^5}+\frac{640\alpha_0}{27\,(x-2)^5}+\Big(-\frac{640\alpha_0}{9(x-2)^4}-\frac{1280\alpha_0}{9\,(x-2)^5}+$$

$$\frac{640}{9(x-2)^4}+\frac{2560}{9(x-2)^5}+\frac{2560}{9\,(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{320\alpha_0}{3(x-2)^4}+\frac{640\,\alpha_0}{3(x-2)^5}-\frac{320}{3(x-2)^4}-\frac{1280}{3\,(x-2)^5}-\frac{1280}{3(x-2)^6}\Big)H(1;\alpha_0)+$$

$$\Big(\frac{1280\alpha_0}{3\,(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-\frac{1280}{3\,(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\,\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+$$

$$\frac{2560}{(x-\,2)^6}\Big)H(0,1;\alpha_0)+\Big(-\frac{640\alpha_0}{(x-2)^4}-\frac{1280\,\alpha_0}{(x-2)^5}+\frac{640}{(x-2)^4}+\frac{2560}{(x-2)^5}+\frac{2560}{(x-\,2)^6}\Big)H(1,0;\alpha_0)+\Big(\frac{960\alpha_0}{(x-2)^4}+\frac{1920\,\alpha_0}{(x-2)^5}-$$

$$\frac{960}{(x-2)^4}-\frac{3840}{(x-2)^5}-\frac{3840}{(x-\,2)^6}\Big)H(1,1;\alpha_0)+\frac{40\pi^2}{9(x-2)^4}-\frac{320}{27\,(x-2)^4}+\frac{160\pi^2}{9(x-2)^5}-\frac{1280}{27\,(x-2)^5}+\frac{160\pi^2}{9(x-2)^6}-\frac{1280}{27\,(x-2)^6}\Big)+$$

$$H(c_1(\alpha_0);x)\Big(-\frac{37x\alpha_0^5}{36}-\frac{31\,\alpha_0^5}{18(x-2)}+\frac{37\alpha_0^5}{36(x-1)}+\frac{9\,\alpha_0^5}{8}+\frac{245x\alpha_0^4}{36}+\frac{73\alpha_0^4}{12(x-2)}-\frac{151\,\alpha_0^4}{36(x-1)}-\frac{65\alpha_0^4}{9(x-2)^2}+\frac{5\alpha_0^4}{3\,(x-1)^2}-$$

$$\frac{497\alpha_0^4}{72}-\frac{182x\alpha_0^3}{9}-\frac{52\alpha_0^3}{9\,(x-2)}+\frac{187\alpha_0^3}{36(x-1)}+\frac{44\alpha_0^3}{3\,(x-2)^2}-\frac{211\alpha_0^3}{36(x-1)^2}-\frac{40\,\alpha_0^3}{(x-2)^3}+\frac{59\alpha_0^3}{18(x-1)^3}+\frac{353\,\alpha_0^3}{18}+\frac{122x\alpha_0^2}{3}-\frac{91\alpha_0^2}{9(x-2)}+$$

$$\frac{275\,\alpha_0^2}{36(x-1)}+\frac{34\alpha_0^2}{3(x-2)^2}+\frac{167\alpha_0^2}{36\,(x-1)^2}-\frac{268\alpha_0^2}{9(x-2)^3}-\frac{38\alpha_0^2}{3\,(x-1)^3}-\frac{3760\alpha_0^2}{9(x-2)^4}+\frac{95\alpha_0^2}{9\,(x-1)^4}-\frac{781\alpha_0^2}{18}-\frac{171x\alpha_0}{4}-\frac{610\alpha_0}{3\,(x-2)}+$$

$$\frac{3965\alpha_0}{18(x-1)}+\frac{228\alpha_0}{(x-2)^2}-\frac{797\,\alpha_0}{18(x-1)^2}-\frac{1312\alpha_0}{9(x-2)^3}+\frac{34\,\alpha_0}{(x-1)^3}+\frac{1808\alpha_0}{(x-2)^4}-\frac{\pi^2\alpha_0}{18(x-1)^4}+\frac{3101\alpha_0}{216(x-1)^4}+\frac{10240\alpha_0}{9(x-2)^5}+\frac{\pi^2\,\alpha_0}{18(x-1)^5}-$$

$$\frac{2125\alpha_0}{108(x-1)^5}+\frac{1315\,\alpha_0}{72}+\frac{595x}{36}+\Big(\frac{2x\alpha_0^5}{3}+\frac{4\alpha_0^5}{3\,(x-2)}-\frac{2\alpha_0^5}{3(x-1)}-\alpha_0^5-\frac{38x\alpha_0^4}{9}-\frac{46\,\alpha_0^4}{9(x-2)}+\frac{26\alpha_0^4}{9(x-1)}+\frac{40\alpha_0^4}{9\,(x-2)^2}-\frac{8\alpha_0^4}{9(x-1)^2}+$$

$$\frac{49\alpha_0^4}{9}+\frac{104x\,\alpha_0^3}{9}+\frac{64\alpha_0^3}{9(x-2)}-\frac{44\alpha_0^3}{9(x-1)}-\frac{104\,\alpha_0^3}{9(x-2)^2}+\frac{28\alpha_0^3}{9(x-1)^2}+\frac{160\alpha_0^3}{9\,(x-2)^3}-\frac{4\alpha_0^3}{3(x-1)^3}-\frac{38\alpha_0^3}{3}-\frac{56x\,\alpha_0^2}{3}-\frac{4\alpha_0^2}{x-2}+\frac{4\alpha_0^2}{x-1}+$$

$$\frac{8\,\alpha_0^2}{(x-2)^2}-\frac{4\alpha_0^2}{(x-1)^2}-\frac{16\,\alpha_0^2}{(x-2)^3}+\frac{4\alpha_0^2}{(x-1)^3}+\frac{320\alpha_0^2}{3\,(x-2)^4}-\frac{8\alpha_0^2}{3(x-1)^4}+18\alpha_0^2+\frac{146x\,\alpha_0}{9}+\frac{512\alpha_0}{9(x-2)}-\frac{62\alpha_0}{x-1}-\frac{608\alpha_0}{9\,(x-2)^2}+$$

$$\frac{148\alpha_0}{9(x-1)^2}+\frac{64\alpha_0}{(x-2)^3}-\frac{94\,\alpha_0}{9(x-1)^3}-\frac{576\alpha_0}{(x-2)^4}-\frac{73\alpha_0}{9\,(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}+\frac{94\alpha_0}{9(x-1)^5}-\frac{61\,\alpha_0}{9}-\frac{50x}{9}+\frac{352}{9\,(x-2)}-\frac{40}{x-1}-\frac{416}{9(x-2)^2}+$$

$$\frac{50}{9\,(x-1)^2}+\frac{640}{9(x-2)^3}-\frac{4}{9(x-1)^3}+\frac{896}{3\,(x-2)^4}+\frac{139}{9(x-1)^4}+\frac{2560}{3(x-2)^5}+\frac{94}{9\,(x-1)^5}-3\Big)H(0;\alpha_0)+\Big(-x\alpha_0^5-\frac{2\,\alpha_0^5}{x-2}+$$

$$\frac{\alpha_0^5}{x-1}+\frac{3\alpha_0^5}{2}+\frac{19x\alpha_0^4}{3}+\frac{23\alpha_0^4}{3(x-2)}-\frac{13\alpha_0^4}{3(x-1)}-\frac{20\alpha_0^4}{3\,(x-2)^2}+\frac{4\alpha_0^4}{3(x-1)^2}-\frac{49\alpha_0^4}{6}-\frac{52x\,\alpha_0^3}{3}-\frac{32\alpha_0^3}{3(x-2)}+\frac{22\alpha_0^3}{3(x-1)}+\frac{52\,\alpha_0^3}{3(x-2)^2}-$$

$$\frac{14\alpha_0^3}{3(x-1)^2}-\frac{80\alpha_0^3}{3\,(x-2)^3}+\frac{2\alpha_0^3}{(x-1)^3}+19\alpha_0^3+28x\alpha_0^2+\frac{6\,\alpha_0^2}{x-2}-\frac{6\alpha_0^2}{x-1}-\frac{12\alpha_0^2}{(x-2)^2}+\frac{6\,\alpha_0^2}{(x-1)^2}+\frac{24\alpha_0^2}{(x-2)^3}-\frac{6\,\alpha_0^2}{(x-1)^3}-\frac{160\alpha_0^2}{(x-2)^4}+$$

$$\frac{4\alpha_0^2}{(x-1)^4}-27\,\alpha_0^2-\frac{73x\alpha_0}{3}-\frac{256\alpha_0}{3(x-2)}+\frac{93\,\alpha_0}{x-1}+\frac{304\alpha_0}{3(x-2)^2}-\frac{74\alpha_0}{3(x-1)^2}-\frac{96\,\alpha_0}{(x-2)^3}+\frac{47\alpha_0}{3(x-1)^3}+\frac{864\,\alpha_0}{(x-2)^4}+\frac{73\alpha_0}{6(x-1)^4}+\frac{640\,\alpha_0}{(x-2)^5}-$$

$$\frac{47\alpha_0}{3(x-1)^5}+\frac{61\alpha_0}{6}+\frac{25\,x}{3}-\frac{176}{3(x-2)}+\frac{60}{x-1}+\frac{208}{3\,(x-2)^2}-\frac{25}{3(x-1)^2}-\frac{320}{3(x-2)^3}+\frac{2}{3\,(x-1)^3}-\frac{448}{(x-2)^4}-\frac{139}{6\,(x-1)^4}-$$

$$\frac{1280}{(x-2)^5}-\frac{47}{3(x-1)^5}+\frac{9}{2}\Big)H(1;\alpha_0)+\Big(\frac{16\alpha_0}{3(x-1)^4}-\frac{16\alpha_0}{3\,(x-1)^5}-\frac{16}{3(x-1)^4}-\frac{16}{3(x-1)^5}\Big)H(0,0;\alpha_0)+\Big(-\frac{8\alpha_0}{(x-1)^4}+$$

$$\frac{8\,\alpha_0}{(x-1)^5}+\frac{8}{(x-1)^4}+\frac{8}{(x-1)^5}\Big)H(0,1;\alpha_0)+\Big(-\frac{8\alpha_0}{(x-1)^4}+\frac{8\,\alpha_0}{(x-1)^5}+\frac{8}{(x-1)^4}+\frac{8}{(x-1)^5}\Big)H(1,0;\alpha_0)+\Big(\frac{12\alpha_0}{(x-1)^4}-$$

$$\frac{12\,\alpha_0}{(x-1)^5}-\frac{12}{(x-1)^4}-\frac{12}{(x-1)^5}\Big)H(1,1;\alpha_0)-\frac{1372}{9(x-2)}+\frac{5705}{36(x-1)}+\frac{512}{3\,(x-2)^2}-\frac{475}{36(x-1)^2}-\frac{2432}{9(x-2)^3}-\frac{35}{12\,(x-1)^3}-$$

$$\frac{7264}{9(x-2)^4}+\frac{\pi^2}{18\,(x-1)^4}-\frac{7679}{216(x-1)^4}-\frac{20480}{9(x-2)^5}+\frac{\pi^2}{18(x-1)^5}-\frac{2125}{108\,(x-1)^5}+\frac{271}{24}\Big)+\Big(-\frac{14x\alpha_0}{3}-\frac{320\,\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{3(x-1)^4}-$$

$$\frac{800\,\alpha_0}{(x-2)^5}-\frac{64\alpha_0}{3(x-1)^5}+\frac{28\alpha_0}{3}+\frac{14\,x}{3}+\frac{320}{(x-2)^4}-\frac{64}{3\,(x-1)^4}+\frac{1440}{(x-2)^5}-\frac{64}{3\,(x-1)^5}+\frac{1600}{(x-2)^6}\Big)H(0;\alpha_0)H(1,1;x)+$$

$$\Big(\frac{47x\,\alpha_0}{9}+\frac{838\alpha_0}{9(x-2)}-\frac{102\alpha_0}{x-1}-\frac{1000\alpha_0}{9(x-2)^2}+\frac{433\alpha_0}{18(x-1)^2}+\frac{128\alpha_0}{(x-2)^3}-\frac{113\alpha_0}{9(x-1)^3}-\frac{4288\alpha_0}{9(x-2)^4}-\frac{137\alpha_0}{9(x-1)^4}+\frac{640\alpha_0}{9(x-2)^5}+$$
$$\frac{188\alpha_0}{9(x-1)^5}-\frac{77\alpha_0}{18}-\frac{47x}{9}+\Big(-\frac{8x\alpha_0}{3}-\frac{448\alpha_0}{3(x-2)^4}+\frac{32\alpha_0}{3(x-1)^4}-\frac{1280\alpha_0}{3(x-2)^5}-\frac{32\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+\frac{8x}{3}+\frac{448}{3(x-2)^4}-\frac{32}{3(x-1)^4}+$$
$$\frac{2176}{3(x-2)^5}-\frac{32}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(4x\alpha_0+\frac{224\alpha_0}{(x-2)^4}-\frac{16\alpha_0}{(x-1)^4}+\frac{640\alpha_0}{(x-2)^5}+\frac{16\alpha_0}{(x-1)^5}-8\alpha_0-4x-\frac{224}{(x-2)^4}+$$
$$\frac{16}{(x-1)^4}-\frac{1088}{(x-2)^5}+\frac{16}{(x-1)^5}-\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{578}{9(x-2)}-\frac{203}{3(x-1)}-\frac{676}{9(x-2)^2}+\frac{185}{18(x-1)^2}+\frac{848}{9(x-2)^3}-\frac{11}{9(x-1)^3}+$$
$$\frac{1984}{9(x-2)^4}+\frac{239}{9(x-1)^4}+\frac{7936}{9(x-2)^5}+\frac{188}{9(x-1)^5}-\frac{1280}{9(x-2)^6}-\frac{37}{6}\Big)H(1,c_1(\alpha_0);x)+\Big(\frac{2x\alpha_0}{3}+\frac{1120\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+$$
$$\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{1120}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{5440}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(0;\alpha_0)\;H(2,1;x)+$$
$$\Big(\frac{1600\alpha_0}{9(x-2)^4}+\frac{3200\alpha_0}{9(x-2)^5}+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(\frac{1600\alpha_0}{(x-2)^4}+$$
$$\frac{3200\alpha_0}{(x-2)^5}-\frac{1600}{(x-2)^4}-\frac{6400}{(x-2)^5}-\frac{6400}{(x-2)^6}\Big)H(1;\alpha_0)-\frac{1600}{9(x-2)^4}-\frac{6400}{9(x-2)^5}-\frac{6400}{9(x-2)^6}\Big)H(2,c_2(\alpha_0);x)+\Big(\frac{x\,\alpha_0^5}{2}+$$
$$\frac{5\alpha_0^5}{6(x-2)}-\frac{\alpha_0^5}{3(x-1)}-\frac{3\,\alpha_0^5}{2}-\frac{19x\alpha_0^4}{6}-\frac{65\alpha_0^4}{18(x-2)}+\frac{13\,\alpha_0^4}{9(x-1)}+\frac{25\alpha_0^4}{9(x-2)^2}-\frac{4\alpha_0^4}{9(x-1)^2}+\frac{47\alpha_0^4}{6}+\frac{26x\alpha_0^3}{3}+\frac{55\alpha_0^3}{9(x-2)}-\frac{22\alpha_0^3}{9(x-1)}-$$
$$\frac{80\alpha_0^3}{9(x-2)^2}+\frac{14\,\alpha_0^3}{9(x-1)^2}+\frac{100\alpha_0^3}{9(x-2)^3}-\frac{2\alpha_0^3}{3(x-1)^3}-17\alpha_0^3-14x\alpha_0^2-\frac{5\alpha_0^2}{x-2}+\frac{2\alpha_0^2}{x-1}+\frac{10\alpha_0^2}{(x-2)^2}-\frac{2\alpha_0^2}{(x-1)^2}-\frac{20\,\alpha_0^2}{(x-2)^3}+\frac{2\alpha_0^2}{(x-1)^3}+$$
$$\frac{200\alpha_0^2}{3(x-2)^4}-\frac{4\alpha_0^2}{3(x-1)^4}+21\alpha_0^2+\frac{73x\,\alpha_0}{6}+\frac{440\alpha_0}{9(x-2)}-\frac{913\alpha_0}{18(x-1)}-\frac{560\,\alpha_0}{9(x-2)^2}+\frac{245\alpha_0}{18(x-1)^2}+\frac{80\,\alpha_0}{(x-2)^3}-\frac{71\alpha_0}{9(x-1)^3}-\frac{320\,\alpha_0}{(x-2)^4}-$$
$$\frac{55\alpha_0}{18(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}+\frac{47\alpha_0}{9(x-1)^5}-\frac{53\alpha_0}{6}-\frac{25\,x}{6}+\Big(\frac{8\alpha_0}{3(x-1)^4}-\frac{8\alpha_0}{3(x-1)^5}-\frac{8}{3(x-1)^4}-\frac{8}{3(x-1)^5}\Big)H(0;\alpha_0)+$$
$$\Big(-\frac{4\,\alpha_0}{(x-1)^4}+\frac{4\,\alpha_0}{(x-1)^5}+\frac{4}{(x-1)^4}+\frac{4}{(x-1)^5}\Big)\;H(1;\alpha_0)+\frac{280}{9(x-2)}-\frac{581}{18(x-1)}-\frac{320}{9(x-2)^2}+\frac{29}{6(x-1)^2}+\frac{400}{9(x-2)^3}-$$
$$\frac{8}{9(x-1)^3}+\frac{320}{3(x-2)^4}+\frac{157}{18(x-1)^4}+\frac{1600}{3(x-2)^5}+\frac{47}{9(x-1)^5}-\frac{3}{2}\Big)\;H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{x\alpha_0^5}{6}-\frac{\alpha_0^5}{6(x-1)}+\frac{\alpha_0^5}{2}+$$
$$\frac{19x\alpha_0^4}{18}+\frac{13\alpha_0^4}{18(x-1)}-\frac{2\alpha_0^4}{9(x-1)^2}-\frac{47\alpha_0^4}{18}-\frac{26x\,\alpha_0^3}{9}-\frac{11\alpha_0^3}{9(x-1)}+\frac{7\alpha_0^3}{9(x-1)^2}-\frac{\alpha_0^3}{3(x-1)^3}+\frac{17\alpha_0^3}{3}+\frac{14x\,\alpha_0^2}{3}+\frac{\alpha_0^2}{x-1}-\frac{\alpha_0^2}{(x-1)^2}+$$
$$\frac{\alpha_0^2}{(x-1)^3}-\frac{2\alpha_0^2}{3(x-1)^4}-7\alpha_0^2-\frac{73x\alpha_0}{18}+\frac{8\,\alpha_0}{9(x-2)}+\frac{\alpha_0}{18(x-1)}-\frac{8\alpha_0}{9(x-2)^2}+\frac{\alpha_0}{9(x-1)^2}+\frac{\alpha_0}{3(x-1)^3}-\frac{32\alpha_0}{9(x-2)^4}-\frac{4\alpha_0}{3(x-1)^4}-$$
$$\frac{640\alpha_0}{9(x-2)^5}+\frac{41\,\alpha_0}{18}+\frac{25x}{18}+\Big(\frac{448\alpha_0}{3(x-2)^4}+\frac{1280\,\alpha_0}{3(x-2)^5}-\frac{448}{3(x-2)^4}-\frac{2176}{3(x-2)^5}-\frac{2560}{3(x-2)^6}\Big)H(0;\alpha_0)+\Big(-\frac{224\,\alpha_0}{(x-2)^4}-$$
$$\frac{640\,\alpha_0}{(x-2)^5}+\frac{224}{(x-2)^4}+\frac{1088}{(x-2)^5}+\frac{1280}{(x-2)^6}\Big)H(1;\alpha_0)+\frac{16}{9(x-2)}-\frac{7}{18(x-1)}-\frac{8}{9(x-2)^2}-\frac{5}{9(x-1)^2}+\frac{16}{9(x-2)^3}-\frac{1}{(x-1)^3}+$$
$$\frac{32}{9(x-2)^4}-\frac{2}{3(x-1)^4}+\frac{704}{9(x-2)^5}+\frac{1280}{9(x-2)^6}+\frac{7}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{16x\,\alpha_0}{3}+\frac{1280\alpha_0}{3(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}+$$
$$\frac{2560\alpha_0}{3(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}-\frac{32\,\alpha_0}{3}-\frac{16x}{3}-\frac{1280}{3(x-2)^4}-\frac{16}{3(x-1)^4}-\frac{5120}{3(x-2)^5}-\frac{16}{3(x-1)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0,0;\alpha_0)+$$
$$\Big(\frac{16x\alpha_0}{3}-\frac{1280\alpha_0}{3(x-2)^4}-\frac{16\alpha_0}{3(x-1)^4}-\frac{2560\alpha_0}{3(x-2)^5}+\frac{16\,\alpha_0}{3(x-1)^5}-\frac{32\alpha_0}{3}-\frac{16x}{3}+\frac{1280}{3(x-2)^4}+\frac{16}{3(x-1)^4}+\frac{5120}{3(x-2)^5}+\frac{16}{3(x-1)^5}+$$
$$\frac{5120}{3(x-2)^6}\Big)H(0,0,0;x)+\Big(-8x\,\alpha_0-\frac{640\alpha_0}{(x-2)^4}-\frac{8\alpha_0}{(x-1)^4}-\frac{1280\,\alpha_0}{(x-2)^5}+\frac{8\alpha_0}{(x-1)^5}+16\alpha_0+8\,x+\frac{640}{(x-2)^4}+\frac{8}{(x-1)^4}+$$
$$\frac{2560}{(x-2)^5}+\frac{8}{(x-1)^5}+\frac{2560}{(x-2)^6}\Big)H(0,0,1;\alpha_0)+\Big(-\frac{8x\,\alpha_0}{3}-\frac{544\alpha_0}{3(x-2)^4}+\frac{8\alpha_0}{3(x-1)^4}-\frac{1280\,\alpha_0}{3(x-2)^5}-\frac{8\alpha_0}{3(x-1)^5}+\frac{16\alpha_0}{3}+$$
$$\frac{8\,x}{3}+\frac{544}{3(x-2)^4}-\frac{8}{3(x-1)^4}+\frac{2368}{3(x-2)^5}-\frac{8}{3(x-1)^5}+\frac{2560}{3(x-2)^6}\Big)\;H(0,0,c_1(\alpha_0);x)+\Big(\frac{1280\alpha_0}{3(x-2)^4}+\frac{2560\alpha_0}{3(x-2)^5}-$$
$$\frac{1280}{3(x-2)^4}-\frac{5120}{3(x-2)^5}-\frac{5120}{3(x-2)^6}\Big)H(0,0,c_2(\alpha_0);x)+\Big(-8x\alpha_0-\frac{640\,\alpha_0}{(x-2)^4}-\frac{8\alpha_0}{(x-1)^4}-\frac{1280\alpha_0}{(x-2)^5}+\frac{8\,\alpha_0}{(x-1)^5}+16\alpha_0+$$
$$8\,x+\frac{640}{(x-2)^4}+\frac{8}{(x-1)^4}+\frac{2560}{(x-2)^5}+\frac{8}{(x-1)^5}+\frac{2560}{(x-2)^6}\Big)H(0,1,0;\alpha_0)+\Big(\frac{20x\,\alpha_0}{3}+\frac{1216\alpha_0}{3(x-2)^4}-\frac{20\alpha_0}{3(x-1)^4}+$$
$$\frac{3200\alpha_0}{3(x-2)^5}+\frac{20\alpha_0}{3(x-1)^5}-\frac{40\,\alpha_0}{3}-\frac{20x}{3}-\frac{1216}{3(x-2)^4}+\frac{20}{3(x-1)^4}-\frac{5632}{3(x-2)^5}+\frac{20}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(0,1,0;x)+$$
$$\Big(12x\alpha_0+\frac{960\,\alpha_0}{(x-2)^4}+\frac{12\alpha_0}{(x-1)^4}+\frac{1920\,\alpha_0}{(x-2)^5}-\frac{12\alpha_0}{(x-1)^5}-24\alpha_0-12x-\frac{960}{(x-2)^4}-\frac{12}{(x-1)^4}-\frac{3840}{(x-2)^5}-\frac{12}{(x-1)^5}-$$
$$\underline{3840}(x-2)^6\Big)H(0,1,1;\alpha_0)+\Big(-\frac{20x\alpha_0}{3}-\frac{1216\,\alpha_0}{3(x-2)^4}+\frac{20\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{20\alpha_0}{3(x-1)^5}+\frac{40\alpha_0}{3}+\frac{20\,x}{3}+\frac{1216}{3(x-2)^4}-$$
$$\frac{20}{3(x-1)^4}+\frac{5632}{3(x-2)^5}-\frac{20}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big)\;H(0,1,c_1(\alpha_0);x)+\Big(\frac{3200\alpha_0}{3(x-2)^4}+\frac{6400\alpha_0}{3(x-2)^5}-\frac{3200}{3(x-2)^4}-\frac{12800}{3(x-2)^5}-$$
$$\frac{12800}{3(x-2)^6}\Big)H(0,2,0;x)+\Big(-\frac{3200\,\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)\;H(0,2,c_2(\alpha_0);x)+\Big(-$$

$$2x\alpha_0-\frac{160\alpha_0}{3(x-2)^4}+\frac{4\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}-\frac{4\alpha_0}{3(x-1)^5}+4\alpha_0+2x+\frac{160}{3(x-2)^4}-\frac{4}{3(x-1)^4}+\frac{1120}{3(x-2)^5}-\frac{4}{3(x-1)^5}+$$
$$\frac{1600}{3(x-2)^6}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2x\alpha_0}{3}+\frac{448\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{1280\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{448}{3(x-2)^4}+$$
$$\frac{2}{3(x-1)^4}-\frac{2176}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{2560}{3(x-2)^6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8x\alpha_0}{3}+\frac{448\alpha_0}{3(x-2)^4}-\frac{32\alpha_0}{3(x-1)^4}+\frac{1280\alpha_0}{3(x-2)^5}+$$
$$\frac{32\alpha_0}{3(x-1)^5}-\frac{16\alpha_0}{3}-\frac{8x}{3}-\frac{448}{3(x-2)^4}+\frac{32}{3(x-1)^4}-\frac{2176}{3(x-2)^5}+\frac{32}{3(x-1)^5}-\frac{2560}{3(x-2)^6}\Big)H(1,0,0;x)+\Big(-\frac{2x\alpha_0}{3}-\frac{96\alpha_0}{(x-2)^4}+$$
$$\frac{16\alpha_0}{3(x-1)^4}-\frac{160\alpha_0}{(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+\frac{2x}{3}+\frac{96}{(x-2)^4}-\frac{16}{3(x-1)^4}+\frac{352}{(x-2)^5}-\frac{16}{3(x-1)^5}+\frac{320}{(x-2)^6}\Big)H(1,0,c_1(\alpha_0);x)+$$
$$\Big(\frac{14x\alpha_0}{3}+\frac{320\alpha_0}{(x-2)^4}-\frac{64\alpha_0}{3(x-1)^4}+\frac{800\alpha_0}{(x-2)^5}+\frac{64\alpha_0}{3(x-1)^5}-\frac{28\alpha_0}{3}-\frac{14x}{3}-\frac{320}{(x-2)^4}+\frac{64}{3(x-1)^4}-\frac{1440}{(x-2)^5}+\frac{64}{3(x-1)^5}-$$
$$\frac{1600}{(x-2)^6}\Big)H(1,1,0;x)+\Big(-\frac{14x\alpha_0}{3}-\frac{320\alpha_0}{(x-2)^4}+\frac{64\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{(x-2)^5}-\frac{64\alpha_0}{3(x-1)^5}+\frac{28\alpha_0}{3}+\frac{14x}{3}+\frac{320}{(x-2)^4}-\frac{64}{3(x-1)^4}+$$
$$\frac{1440}{(x-2)^5}-\frac{64}{3(x-1)^5}+\frac{1600}{(x-2)^6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-2x\alpha_0-\frac{160\alpha_0}{3(x-2)^4}+\frac{16\alpha_0}{3(x-1)^4}-\frac{800\alpha_0}{3(x-2)^5}-\frac{16\alpha_0}{3(x-1)^5}+4\alpha_0+$$
$$2x+\frac{160}{3(x-2)^4}-\frac{16}{3(x-1)^4}+\frac{1120}{3(x-2)^5}-\frac{16}{3(x-1)^5}+\frac{1600}{3(x-2)^6}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{3200\alpha_0}{3(x-2)^4}+\frac{6400\alpha_0}{3(x-2)^5}-$$
$$\frac{3200}{3(x-2)^4}-\frac{12800}{3(x-2)^5}-\frac{12800}{3(x-2)^6}\Big)H(2,0,0;x)+\Big(\frac{2x\alpha_0}{3}+\frac{1120\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-$$
$$\frac{1120}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{5440}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(2,0,c_1(\alpha_0);x)+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+$$
$$\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)H(2,0,c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{1120\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+$$
$$\frac{2x}{3}+\frac{1120}{3(x-2)^4}-\frac{2}{3(x-1)^4}+\frac{5440}{3(x-2)^5}-\frac{2}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big)H(2,1,0;x)+\Big(\frac{2x\alpha_0}{3}+\frac{1120\alpha_0}{3(x-2)^4}-\frac{2\alpha_0}{3(x-1)^4}+$$
$$\frac{3200\alpha_0}{3(x-2)^5}+\frac{2\alpha_0}{3(x-1)^5}-\frac{4\alpha_0}{3}-\frac{2x}{3}-\frac{1120}{3(x-2)^4}+\frac{2}{3(x-1)^4}-\frac{5440}{3(x-2)^5}+\frac{2}{3(x-1)^5}-\frac{6400}{3(x-2)^6}\Big)H(2,1,c_1(\alpha_0);x)+$$
$$\Big(-\frac{8000\alpha_0}{3(x-2)^4}-\frac{16000\alpha_0}{3(x-2)^5}+\frac{8000}{3(x-2)^4}+\frac{32000}{3(x-2)^5}+\frac{32000}{3(x-2)^6}\Big)H(2,2,0;x)+\Big(\frac{8000\alpha_0}{3(x-2)^4}+\frac{16000\alpha_0}{3(x-2)^5}-\frac{8000}{3(x-2)^4}-$$
$$\frac{32000}{3(x-2)^5}-\frac{32000}{3(x-2)^6}\Big)H(2,2,c_2(\alpha_0);x)+\Big(-\frac{2x\alpha_0}{3}-\frac{1120\alpha_0}{3(x-2)^4}+\frac{2\alpha_0}{3(x-1)^4}-\frac{3200\alpha_0}{3(x-2)^5}-\frac{2\alpha_0}{3(x-1)^5}+\frac{4\alpha_0}{3}+$$
$$\frac{2x}{3}+\frac{1120}{3(x-2)^4}-\frac{2}{3(x-1)^4}+\frac{5440}{3(x-2)^5}-\frac{2}{3(x-1)^5}+\frac{6400}{3(x-2)^6}\Big)H(2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{4\alpha_0}{3(x-1)^4}-$$
$$\frac{4\alpha_0}{3(x-1)^5}-\frac{4}{3(x-1)^4}-\frac{4}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{2\alpha_0}{3(x-1)^4}-\frac{2\alpha_0}{3(x-1)^5}-\frac{2}{3(x-1)^4}-$$
$$\frac{2}{3(x-1)^5}\Big)H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{32\alpha_0}{(x-2)^4}-\frac{32}{(x-2)^4}-\frac{64}{(x-2)^5}\Big)H(c_2(\alpha_0),0,c_1(\alpha_0);x)+\Big(\frac{160\alpha_0}{3(x-2)^4}+$$
$$\frac{800\alpha_0}{3(x-2)^5}-\frac{160}{3(x-2)^4}-\frac{1120}{3(x-2)^5}-\frac{1600}{3(x-2)^6}\Big)H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+H(2,0;x)\Big(-\frac{1600\alpha_0}{9(x-2)^4}-$$
$$\frac{3200\alpha_0}{9(x-2)^5}-\frac{3200\ln 2\,\alpha_0}{3(x-2)^4}-\frac{6400\ln 2\,\alpha_0}{3(x-2)^5}+\frac{1600}{9(x-2)^4}+\frac{6400}{9(x-2)^5}+\frac{6400}{9(x-2)^6}+\frac{3200\ln 2}{3(x-2)^4}+\frac{12800\ln 2}{3(x-2)^5}+\frac{12800\ln 2}{3(x-2)^6}\Big)+$$
$$H(0,2;x)\Big(-\frac{3200\ln 2\,\alpha_0}{3(x-2)^4}-\frac{6400\ln 2\,\alpha_0}{3(x-2)^5}+\Big(-\frac{3200\alpha_0}{3(x-2)^4}-\frac{6400\alpha_0}{3(x-2)^5}+\frac{3200}{3(x-2)^4}+\frac{12800}{3(x-2)^5}+\frac{12800}{3(x-2)^6}\Big)H(0;\alpha_0)+$$
$$\frac{3200\ln 2}{3(x-2)^4}+\frac{12800\ln 2}{3(x-2)^5}+\frac{12800\ln 2}{3(x-2)^6}\Big)+H(0,0;x)\Big(-\frac{94x\alpha_0}{9}-\frac{512\alpha_0}{9(x-2)}+\frac{62\alpha_0}{x-1}+\frac{608\alpha_0}{9(x-2)^2}-\frac{148\alpha_0}{9(x-1)^2}-\frac{64\alpha_0}{(x-2)^3}+$$
$$\frac{94\alpha_0}{9(x-1)^3}+\frac{4480\alpha_0}{9(x-2)^4}+\frac{49\alpha_0}{9(x-1)^4}+\frac{1280\alpha_0}{9(x-2)^5}-\frac{94\alpha_0}{9(x-1)^5}+\frac{1280\ln 2\,\alpha_0}{3(x-2)^4}+\frac{2560\ln 2\,\alpha_0}{3(x-2)^5}+\frac{161\alpha_0}{9}+\frac{94x}{9}-\frac{352}{9(x-2)}+\frac{40}{x-1}+$$
$$\frac{416}{9(x-2)^2}-\frac{50}{9(x-1)^2}-\frac{640}{9(x-2)^3}+\frac{4}{9(x-1)^3}-\frac{3328}{9(x-2)^4}-\frac{139}{9(x-1)^4}-\frac{10240}{9(x-2)^5}-\frac{94}{9(x-1)^5}-\frac{2560}{9(x-2)^6}-\frac{1280\ln 2}{3(x-2)^4}-$$
$$\frac{5120\ln 2}{3(x-2)^5}-\frac{5120\ln 2}{3(x-2)^6}+3\Big)+H(2,2;x)\Big(\frac{8000\ln 2\,\alpha_0}{3(x-2)^4}+\frac{16000\ln 2\,\alpha_0}{3(x-2)^5}+\Big(\frac{8000\alpha_0}{3(x-2)^4}+\frac{16000\alpha_0}{3(x-2)^5}-\frac{8000}{3(x-2)^4}-\frac{32000}{3(x-2)^5}-$$
$$\frac{32000}{3(x-2)^6}\Big)H(0;\alpha_0)-\frac{8000\ln 2}{3(x-2)^4}-\frac{32000\ln 2}{3(x-2)^5}-\frac{32000\ln 2}{3(x-2)^6}\Big)+H(0;x)\Big(\frac{1}{2}\pi^2x\alpha_0+\frac{2125x\alpha_0}{108}+\frac{1748\alpha_0}{9(x-2)}-\frac{1897\alpha_0}{9(x-1)}-$$
$$\frac{1960\alpha_0}{9(x-2)^2}+\frac{352\alpha_0}{9(x-1)^2}+\frac{496\alpha_0}{3(x-2)^3}-\frac{173\alpha_0}{6(x-1)^3}-\frac{88\pi^2\alpha_0}{3(x-2)^4}-\frac{31040\alpha_0}{27(x-2)^4}-\frac{7\pi^2\alpha_0}{18(x-1)^4}-\frac{821\alpha_0}{216(x-1)^4}-\frac{80\pi^2\alpha_0}{3(x-2)^5}-\frac{640\alpha_0}{27(x-2)^5}+$$
$$\frac{7\pi^2\alpha_0}{18(x-1)^5}+\frac{2125\alpha_0}{108(x-1)^5}-\frac{640\ln^2 2\,\alpha_0}{3(x-2)^4}-\frac{1280\ln^2 2\,\alpha_0}{3(x-2)^5}-\frac{640\ln 2\,\alpha_0}{9(x-2)^4}-\frac{1280\ln 2\,\alpha_0}{9(x-2)^5}-\pi^2\alpha_0-\frac{6061\alpha_0}{216}-\frac{\pi^2x}{2}-\frac{2125x}{108}+$$
$$\frac{1372}{9(x-2)}-\frac{5705}{36(x-1)}-\frac{512}{3(x-2)^2}+\frac{475}{36(x-1)^2}+\frac{2432}{9(x-2)^3}+\frac{35}{12(x-1)^3}+\frac{88\pi^2}{3(x-2)^4}+\frac{22112}{27(x-2)^4}+\frac{7\pi^2}{18(x-1)^4}+\frac{7679}{216(x-1)^4}+$$
$$\frac{256\pi^2}{3(x-2)^5}+\frac{62720}{27(x-2)^5}+\frac{7\pi^2}{18(x-1)^5}+\frac{2125}{108(x-1)^5}+\frac{160\pi^2}{3(x-2)^6}+\frac{1280}{27(x-2)^6}+\frac{640\ln^2 2}{3(x-2)^4}+\frac{2560\ln^2 2}{3(x-2)^5}+\frac{2560\ln^2 2}{3(x-2)^6}+$$
$$\frac{640\ln 2}{9(x-2)^4}+\frac{2560\ln 2}{9(x-2)^5}+\frac{2560\ln 2}{9(x-2)^6}-\frac{271}{24}\Big)+H(2;x)\Big(-\frac{1}{6}\pi^2x\alpha_0+\frac{760\pi^2\alpha_0}{9(x-2)^4}+\frac{\pi^2\alpha_0}{6(x-1)^4}+\frac{800\pi^2\alpha_0}{9(x-2)^5}-\frac{\pi^2\alpha_0}{6(x-1)^5}+$$

$$\frac{1600\ln^2 2\,\alpha_0}{3(x-2)^4} + \frac{3200\ln^2 2\,\alpha_0}{3(x-2)^5} + \frac{1600\ln 2\,\alpha_0}{9(x-2)^4} + \frac{3200\ln 2\,\alpha_0}{9(x-2)^5} + \frac{\pi^2\alpha_0}{3} + \frac{\pi^2 x}{6} + \Big(\frac{1600\alpha_0}{9(x-2)^4} + \frac{3200\alpha_0}{9(x-2)^5} - \frac{1600}{9(x-2)^4} -$$
$$\frac{6400}{9(x-2)^5} - \frac{6400}{9(x-2)^6}\Big)H(0;\alpha_0) + \Big(-\frac{3200\alpha_0}{3(x-2)^4} - \frac{6400\alpha_0}{3(x-2)^5} + \frac{3200}{3(x-2)^4} + \frac{12800}{3(x-2)^5} + \frac{12800}{3(x-2)^6}\Big)H(0,0;\alpha_0) +$$
$$\Big(\frac{1600\alpha_0}{(x-2)^4} + \frac{3200\alpha_0}{(x-2)^5} - \frac{1600}{(x-2)^4} - \frac{6400}{(x-2)^5} - \frac{6400}{(x-2)^6}\Big)H(0,1;\alpha_0) - \frac{760\pi^2}{9(x-2)^4} - \frac{\pi^2}{6(x-1)^4} - \frac{2320\pi^2}{9(x-2)^5} - \frac{\pi^2}{6(x-1)^5} -$$
$$\frac{1600\pi^2}{9(x-2)^6} - \frac{1600\ln^2 2}{3(x-2)^4} - \frac{6400\ln^2 2}{3(x-2)^5} - \frac{6400\ln^2 2}{3(x-2)^6} - \frac{1600\ln 2}{9(x-2)^4} - \frac{6400\ln 2}{9(x-2)^5} - \frac{6400\ln 2}{9(x-2)^6}\Big) - \frac{8\pi^2}{9(x-2)} + \frac{257\pi^2}{216(x-1)} + \frac{14\pi^2}{9(x-2)^2} -$$
$$\frac{7\pi^2}{27(x-1)^2} - \frac{4\pi^2}{(x-2)^3} - \frac{35\pi^2}{108(x-1)^3} - \frac{1160\pi^2}{27(x-2)^4} - \frac{139\pi^2}{108(x-1)^4} - \frac{2192\pi^2}{27(x-2)^5} - \frac{47\pi^2}{54(x-1)^5} - \frac{320\pi^2}{27(x-2)^6} - \frac{17}{12}x\zeta_3 - \frac{56\zeta_3}{3(x-2)^4} +$$
$$\frac{7\zeta_3}{4(x-1)^4} - \frac{392\zeta_3}{3(x-2)^5} + \frac{7\zeta_3}{4(x-1)^5} - \frac{560\zeta_3}{3(x-2)^6} - \frac{640\ln^3 2}{9(x-2)^4} - \frac{2560\ln^3 2}{9(x-2)^5} - \frac{2560\ln^3 2}{9(x-2)^6} - \frac{320\ln^2 2}{9(x-2)^4} - \frac{1280\ln^2 2}{9(x-2)^5} - \frac{1280\ln^2 2}{9(x-2)^6} +$$
$$\frac{1}{6}\pi^2 x\ln 2 - \frac{112\pi^2\ln 2}{3(x-2)^4} - \frac{320\ln 2}{27(x-2)^4} - \frac{\pi^2\ln 2}{6(x-1)^4} - \frac{304\pi^2\ln 2}{3(x-2)^5} - \frac{1280\ln 2}{27(x-2)^5} - \frac{\pi^2\ln 2}{6(x-1)^5} - \frac{160\pi^2\ln 2}{3(x-2)^6} - \frac{1280\ln 2}{27(x-2)^6} + \frac{13\pi^2}{24}\}.$$

E.8 The $\mathcal{B}$ integral for $k = -1$ and $\delta = 1$

The ε expansion for this integral reads

$$\begin{aligned}\mathcal{I}(x,\varepsilon;\alpha_0,3+d_1\varepsilon;1,-1,1,g_B) &= x\,\mathcal{B}(\varepsilon,x;3+d_1\varepsilon;1,-1)\\ &= \frac{1}{\varepsilon^2}b_{-2}^{(1,-1)} + \frac{1}{\varepsilon}b_{-1}^{(1,-1)} + b_0^{(1,-1)} + \varepsilon b_1^{(1,-1)} + \varepsilon^2 b_2^{(1,-1)} + \mathcal{O}\left(\varepsilon^3\right),\end{aligned} \tag{E.8}$$

where

$$b_{-2}^{(1,-1)} = \frac{1}{8},$$

$$b_{-1}^{(1,-1)} = -H(0;x),$$

$$b_0^{(1,-1)} = \frac{\alpha_0^3}{12(x-1)^2} - \frac{\alpha_0^3}{12} + \frac{\alpha_0^2}{24(x-1)} - \frac{5\alpha_0^2}{24(x-1)^2} + \frac{7\alpha_0^2}{24(x-1)^3} + \frac{13\alpha_0^2}{24} - \frac{\alpha_0}{3(x-1)} + \frac{\alpha_0}{6(x-1)^2} - \frac{\alpha_0}{3(x-1)^3} +$$
$$\frac{13\alpha_0}{12(x-1)^4} - \frac{23\alpha_0}{12} + \Big(\frac{25}{12} + \frac{3}{4(x-1)} - \frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5}\Big)H(0;\alpha_0) + \Big(-\frac{25}{12} - \frac{3}{4(x-1)} +$$
$$\frac{1}{6(x-1)^2} + \frac{1}{6(x-1)^3} - \frac{3}{4(x-1)^4} - \frac{25}{12(x-1)^5}\Big)H(0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)H(0;\alpha_0)\,H(1;x) + \Big(-\frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} +$$
$$\frac{\alpha_0^3}{x-1} - \frac{\alpha_0^3}{3(x-1)^2} - \frac{4\alpha_0^3}{3} - \frac{3\alpha_0^2}{2(x-1)} + \frac{\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{2(x-1)^3} + 3\alpha_0^2 + \frac{\alpha_0}{x-1} - \frac{\alpha_0}{(x-1)^2} + \frac{\alpha_0}{(x-1)^3} - \frac{\alpha_0}{(x-1)^4} - 4\alpha_0 + \frac{3}{4(x-1)} -$$
$$\frac{1}{6(x-1)^2} - \frac{1}{6(x-1)^3} + \frac{3}{4(x-1)^4} + \frac{25}{12(x-1)^5} + \frac{25}{12}\Big)H(c_1(\alpha_0);x) + 4H(0,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)H(0,c_1(\alpha_0);x) +$$
$$\Big(1 - \frac{1}{(x-1)^5}\Big)H(1,0;x) + \Big(\frac{1}{(x-1)^5} - 1\Big)H(1,c_1(\alpha_0);x) - \frac{H(c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi^2}{6(x-1)^5} - \frac{\pi^2}{12},$$

$$b_1^{(1,-1)} = \frac{7d_1\alpha_0^3}{72} - \frac{7d_1\alpha_0^3}{72(x-1)^2} + \frac{7\alpha_0^3}{36(x-1)^2} - \frac{7\alpha_0^3}{36} - \frac{109d_1\alpha_0^2}{144} - \frac{13d_1\alpha_0^2}{144(x-1)} - \frac{11\alpha_0^2}{72(x-1)} + \frac{29d_1\alpha_0^2}{144(x-1)^2} - \frac{53\alpha_0^2}{72(x-1)^2} -$$
$$\frac{67d_1\alpha_0^2}{144(x-1)^3} + \frac{79\alpha_0^2}{72(x-1)^3} + \frac{121\alpha_0^2}{72} + \frac{305d_1\alpha_0}{72} + \frac{2\alpha_0}{3(x-2)} + \frac{19d_1\alpha_0}{18(x-1)} - \frac{5\alpha_0}{18(x-1)} - \frac{d_1\alpha_0}{9(x-1)^2} + \frac{5\alpha_0}{9(x-1)^2} + \frac{d_1\alpha_0}{18(x-1)^3} -$$
$$\frac{41\alpha_0}{18(x-1)^3} - \frac{217d_1\alpha_0}{72(x-1)^4} + \frac{271\alpha_0}{36(x-1)^4} - \frac{371\alpha_0}{36} + \Big(-\frac{\alpha_0^3}{3(x-1)^2} + \frac{\alpha_0^3}{3} - \frac{\alpha_0^2}{6(x-1)} + \frac{5\alpha_0^2}{6(x-1)^2} - \frac{7\alpha_0^2}{6(x-1)^3} - \frac{13\alpha_0^2}{6} + \frac{4\alpha_0}{3(x-1)} -$$
$$\frac{2\alpha_0}{3(x-1)^2} + \frac{4\alpha_0}{3(x-1)^3} - \frac{13\alpha_0}{3(x-1)^4} + \frac{23\alpha_0}{3} - \frac{205d_1}{72} - \frac{4}{x-2} - \frac{15d_1}{8(x-1)} + \frac{7}{4(x-1)} + \frac{8}{3(x-2)^2} + \frac{5d_1}{18(x-1)^2} - \frac{1}{18(x-1)^2} +$$
$$\frac{5d_1}{18(x-1)^3} - \frac{31}{18(x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{13}{4(x-1)^4} - \frac{205d_1}{72(x-1)^5} + \frac{415}{36(x-1)^5} + \frac{205}{36}\Big)H(0;\alpha_0) + \Big(\frac{15d_1}{8(x-1)} - \frac{5d_1}{18(x-1)^2} -$$
$$\frac{5d_1}{18(x-1)^3} + \frac{15d_1}{8(x-1)^4} + \frac{205d_1}{72(x-1)^5} + \frac{205d_1}{72} + \frac{4}{x-2} - \frac{7}{4(x-1)} - \frac{8}{3(x-2)^2} + \frac{1}{18(x-1)^2} + \frac{31}{18(x-1)^3} - \frac{13}{4(x-1)^4} + \frac{2\pi^2}{3(x-1)^5} -$$
$$\frac{415}{36(x-1)^5} + \frac{\pi^2}{3} - \frac{205}{36}\Big)H(0;x) + \Big(\frac{d_1\alpha_0^3}{6} - \frac{d_1\alpha_0^3}{6(x-1)^2} - \frac{13d_1\alpha_0^2}{12} - \frac{d_1\alpha_0^2}{12(x-1)} + \frac{5d_1\alpha_0^2}{12(x-1)^2} - \frac{7d_1\alpha_0^2}{12(x-1)^3} + \frac{23d_1\alpha_0}{6} +$$
$$\frac{2d_1\alpha_0}{3(x-1)} - \frac{d_1\alpha_0}{3(x-1)^2} + \frac{2d_1\alpha_0}{3(x-1)^3} - \frac{13d_1\alpha_0}{6(x-1)^4} - \frac{35d_1}{12} - \frac{7d_1}{12(x-1)} + \frac{d_1}{12(x-1)^2} - \frac{d_1}{12(x-1)^3} + \frac{13d_1}{6(x-1)^4}\Big)H(1;\alpha_0) +$$
$$\Big(\frac{\pi^2}{2(x-1)^5} - \frac{\pi^2}{2}\Big)H(2;x) + \Big(-\frac{d_1\alpha_0^4}{8} + \frac{d_1\alpha_0^4}{8(x-1)} - \frac{\alpha_0^4}{4(x-1)} + \frac{\alpha_0^4}{4} + \frac{13d_1\alpha_0^3}{18} - \frac{d_1\alpha_0^3}{2(x-1)} + \frac{5\alpha_0^3}{3(x-1)} + \frac{2d_1\alpha_0^3}{9(x-1)^2} - \frac{7\alpha_0^3}{9(x-1)^2} -$$
$$\frac{13\alpha_0^3}{9} - \frac{23d_1\alpha_0^2}{12} - \frac{\alpha_0^2}{3(x-2)} + \frac{3d_1\alpha_0^2}{4(x-1)} - \frac{9\alpha_0^2}{2(x-1)} - \frac{2d_1\alpha_0^2}{3(x-1)^2} + \frac{7\alpha_0^2}{2(x-1)^2} + \frac{d_1\alpha_0^2}{2(x-1)^3} - \frac{13\alpha_0^2}{6(x-1)^3} + \frac{23\alpha_0^2}{6} + \frac{25d_1\alpha_0}{6} +$$

$$
\frac{2\alpha_0}{x-2} - \frac{d_1\alpha_0}{2(x-1)} + \frac{23\alpha_0}{3(x-1)} - \frac{4\alpha_0}{3(x-2)^2} + \frac{2d_1\alpha_0}{3(x-1)^2} - \frac{20\alpha_0}{3(x-1)^2} - \frac{d_1\alpha_0}{(x-1)^3} + \frac{22\alpha_0}{3(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{25\alpha_0}{3(x-1)^4} - \frac{25\alpha_0}{3} -
$$

$$
\frac{205d_1}{72} + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 - \frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} +
$$

$$
\frac{4\alpha_0}{(x-1)^4} + 16\alpha_0 - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(0;\alpha_0) + \Big(-\frac{d_1\alpha_0^4}{2} + \frac{d_1\alpha_0^4}{2(x-1)} + \frac{8d_1\alpha_0^3}{3} -
$$

$$
\frac{2d_1\alpha_0^3}{x-1} + \frac{2d_1\alpha_0^3}{3(x-1)^2} - 6d_1\alpha_0^2 + \frac{3d_1\alpha_0^2}{x-1} - \frac{2d_1\alpha_0^2}{(x-1)^2} + \frac{d_1\alpha_0^2}{(x-1)^3} + 8d_1\alpha_0 - \frac{2d_1\alpha_0}{x-1} + \frac{2d_1\alpha_0}{(x-1)^2} - \frac{2d_1\alpha_0}{(x-1)^3} + \frac{2d_1\alpha_0}{(x-1)^4} - \frac{25d_1}{6} -
$$

$$
\frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5}\Big) H(1;\alpha_0) - \frac{4}{x-2} - \frac{15d_1}{8(x-1)} + \frac{7}{4(x-1)} + \frac{8}{3(x-2)^2} + \frac{5d_1}{18(x-1)^2} -
$$

$$
\frac{1}{18(x-1)^2} + \frac{5d_1}{18(x-1)^3} - \frac{31}{18(x-1)^3} - \frac{15d_1}{8(x-1)^4} + \frac{13}{4(x-1)^4} - \frac{205d_1}{72(x-1)^5} + \frac{415}{36(x-1)^5} + \frac{205}{36}\Big) H(c_1(\alpha_0);x) + \Big(-
$$

$$
\frac{25}{3} - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} - \frac{25}{3(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(\frac{25}{3} + \frac{3}{x-1} - \frac{2}{3(x-1)^2} - \frac{2}{3(x-1)^3} +
$$

$$
\frac{3}{(x-1)^4} + \frac{25}{3(x-1)^5}\Big) H(0,0;x) + \Big(-\frac{3d_1}{2(x-1)} + \frac{d_1}{3(x-1)^2} + \frac{d_1}{3(x-1)^3} - \frac{3d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} - \frac{25d_1}{6}\Big) H(0,1;\alpha_0) +
$$

$$
H(1;x)\Big(-\frac{\pi^2 d_1}{3(x-1)^5} + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} + \frac{4}{x-2} - \frac{8}{3(x-2)^2} - \frac{4}{3(x-1)^2} + \frac{8}{3(x-2)^3} -
$$

$$
\frac{4}{(x-1)^4}\Big) H(0;\alpha_0) + \Big(4 - \frac{4}{(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(0,1;\alpha_0) + \frac{2\pi^2}{3(x-1)^5}\Big) + \Big(\frac{2d_1}{(x-1)^5} -
$$

$$
2d_1 - \frac{2}{(x-1)^5} + 2\Big) H(0;\alpha_0) H(0,1;x) + \Big(-\frac{\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{x-1} - \frac{2\alpha_0^3}{3(x-1)^2} - \frac{8\alpha_0^3}{3} - \frac{3\alpha_0^2}{x-1} + \frac{2\alpha_0^2}{(x-1)^2} - \frac{\alpha_0^2}{(x-1)^3} +
$$

$$
6\alpha_0^2 + \frac{2\alpha_0}{x-1} - \frac{2\alpha_0}{(x-1)^2} + \frac{2\alpha_0}{(x-1)^3} - \frac{2\alpha_0}{(x-1)^4} - 8\alpha_0 + \Big(4 - \frac{4}{(x-1)^5}\Big) H(0;\alpha_0) + \Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{4}{x-2} -
$$

$$
\frac{1}{2(x-1)} - \frac{8}{3(x-2)^2} - \frac{2}{3(x-1)^2} + \frac{8}{3(x-2)^3} - \frac{1}{(x-1)^3} - \frac{2}{(x-1)^4} + \frac{25}{6}\Big) H(0,c_1(\alpha_0);x) + \Big(-\frac{2d_1}{x-1} + \frac{d_1}{(x-1)^2} -
$$

$$
\frac{2d_1}{3(x-1)^3} + \frac{d_1}{2(x-1)^4} - \frac{25d_1}{6(x-1)^5} - \frac{4}{x-2} + \frac{8}{3(x-2)^2} + \frac{4}{3(x-1)^2} - \frac{8}{3(x-2)^3} + \frac{4}{(x-1)^4}\Big) H(1,0;x) + \Big(\frac{4d_1}{(x-1)^5} - 2d_1 -
$$

$$
\frac{4}{(x-1)^5}\Big) H(0;\alpha_0) H(1,1;x) + \Big(\frac{2d_1}{x-1} - \frac{d_1}{(x-1)^2} + \frac{2d_1}{3(x-1)^3} - \frac{d_1}{2(x-1)^4} + \frac{25d_1}{6(x-1)^5} + \Big(4 - \frac{4}{(x-1)^5}\Big) H(0;\alpha_0) +
$$

$$
\Big(2d_1 - \frac{2d_1}{(x-1)^5}\Big) H(1;\alpha_0) + \frac{4}{x-2} - \frac{8}{3(x-2)^2} - \frac{4}{3(x-1)^2} + \frac{8}{3(x-2)^3} - \frac{4}{(x-1)^4}\Big) H(1,c_1(\alpha_0);x) + \Big(2 -
$$

$$
\frac{2}{(x-1)^5}\Big) H(0;\alpha_0) H(2,1;x) + \Big(\frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{4\alpha_0^3}{x-1} + \frac{4\alpha_0^3}{3(x-1)^2} + \frac{16\alpha_0^3}{3} + \frac{6\alpha_0^2}{x-1} - \frac{4\alpha_0^2}{(x-1)^2} + \frac{2\alpha_0^2}{(x-1)^3} - 12\alpha_0^2 -
$$

$$
\frac{4\alpha_0}{x-1} + \frac{4\alpha_0}{(x-1)^2} - \frac{4\alpha_0}{(x-1)^3} + \frac{4\alpha_0}{(x-1)^4} + 16\alpha_0 + \frac{4H(0;\alpha_0)}{(x-1)^5} + \frac{2d_1H(1;\alpha_0)}{(x-1)^5} - \frac{3}{x-1} + \frac{2}{3(x-1)^2} + \frac{2}{3(x-1)^3} - \frac{3}{(x-1)^4} -
$$

$$
\frac{25}{3(x-1)^5} - \frac{25}{3}\Big) H(c_1(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{\alpha_0^4}{2(x-1)} - \frac{\alpha_0^4}{2} - \frac{2\alpha_0^3}{x-1} + \frac{2\alpha_0^3}{3(x-1)^2} + \frac{8\alpha_0^3}{3} + \frac{3\alpha_0^2}{x-1} - \frac{2\alpha_0^2}{(x-1)^2} + \frac{\alpha_0^2}{(x-1)^3} -
$$

$$
6\alpha_0^2 - \frac{2\alpha_0}{x-1} + \frac{2\alpha_0}{(x-1)^2} - \frac{2\alpha_0}{(x-1)^3} + \frac{2\alpha_0}{(x-1)^4} + 8\alpha_0 - \frac{4}{x-2} + \frac{1}{2(x-1)} + \frac{8}{3(x-2)^2} + \frac{2}{3(x-1)^2} - \frac{8}{3(x-2)^3} +
$$

$$
\frac{1}{(x-1)^3} + \frac{2}{(x-1)^4} - \frac{25}{6}\Big) H(c_2(\alpha_0),c_1(\alpha_0);x) - 16H(0,0,0;x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,0,c_1(\alpha_0);x) +
$$

$$
\Big(-\frac{2d_1}{(x-1)^5} + 2d_1 + \frac{2}{(x-1)^5} - 2\Big) H(0,1,0;x) + \Big(\frac{2d_1}{(x-1)^5} - 2d_1 - \frac{2}{(x-1)^5} + 2\Big) H(0,1,c_1(\alpha_0);x) +
$$

$$
4H(0,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(0,c_2(\alpha_0),c_1(\alpha_0);x) + \Big(\frac{4}{(x-1)^5} - 4\Big) H(1,0,0;x) +
$$

$$
\Big(\frac{2d_1}{(x-1)^5} - \frac{4}{(x-1)^5}\Big) H(1,0,c_1(\alpha_0);x) + \Big(-\frac{4d_1}{(x-1)^5} + 2d_1 + \frac{4}{(x-1)^5}\Big) H(1,1,0;x) + \Big(\frac{4d_1}{(x-1)^5} - 2d_1 -
$$

$$
\frac{4}{(x-1)^5}\Big) H(1,1,c_1(\alpha_0);x) + \Big(4 - \frac{2d_1}{(x-1)^5}\Big) H(1,c_1(\alpha_0),c_1(\alpha_0);x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(2,0,c_1(\alpha_0);x) +
$$

$$
\Big(\frac{2}{(x-1)^5} - 2\Big) H(2,1,0;x) + \Big(2 - \frac{2}{(x-1)^5}\Big) H(2,1,c_1(\alpha_0);x) + \Big(\frac{2}{(x-1)^5} - 2\Big) H(2,c_2(\alpha_0),c_1(\alpha_0);x) -
$$

$$
\frac{2H(c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5} + \frac{4H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} + \frac{2H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5} - \frac{\pi^2}{x-2} + \frac{\pi^2}{8(x-1)} + \frac{2\pi^2}{3(x-2)^2} +
$$

$$
\frac{\pi^2}{6(x-1)^2} - \frac{2\pi^2}{3(x-2)^3} + \frac{\pi^2}{4(x-1)^3} + \frac{\pi^2}{2(x-1)^4} - \frac{21\zeta_3}{4(x-1)^5} - \frac{33\zeta_3}{4} + \frac{\pi^2\ln 2}{2(x-1)^5} - \frac{1}{2}\pi^2\ln 2 - \frac{25\pi^2}{24},
$$

$$
b_2^{(1,-1)} = -\frac{37}{432}d_1^2\alpha_0^3 + \frac{37d_1\alpha_0^3}{108} + \frac{37d_1^2\alpha_0^3}{432(x-1)^2} - \frac{37d_1\alpha_0^3}{108(x-1)^2} - \frac{\pi^2\alpha_0^3}{72(x-1)^2} + \frac{37\alpha_0^3}{108(x-1)^2} + \frac{\pi^2\alpha_0^3}{72} - \frac{37\alpha_0^3}{108} + \frac{715d_1^2\alpha_0^2}{864} -
$$

$$
\frac{793d_1\alpha_0^2}{216} + \frac{115d_1^2\alpha_0^2}{864(x-1)} + \frac{41d_1\alpha_0^2}{216(x-1)} - \frac{\pi^2\alpha_0^2}{144(x-1)} - \frac{197\alpha_0^2}{216(x-1)} - \frac{107d_1^2\alpha_0^2}{864(x-1)^2} + \frac{263d_1\alpha_0^2}{216(x-1)^2} + \frac{5\pi^2\alpha_0^2}{144(x-1)^2} - \frac{419\alpha_0^2}{216(x-1)^2} +
$$

$$
\frac{493d_1^2\alpha_0^2}{864(x-1)^3} - \frac{571d_1\alpha_0^2}{216(x-1)^3} - \frac{7\pi^2\alpha_0^2}{144(x-1)^3} + \frac{649\alpha_0^2}{216(x-1)^3} - \frac{13\pi^2\alpha_0^2}{144} + \frac{871\alpha_0^2}{216} - \frac{3515d_1^2\alpha_0}{432} + \frac{1040d_1\alpha_0}{27} - \frac{25d_1\alpha_0}{9(x-2)} + \frac{50\alpha_0}{9(x-2)} -
$$

$$\frac{265d_1^2\alpha_0}{108(x-1)}+\frac{523d_1\alpha_0}{108(x-1)}+\frac{\pi^2\alpha_0}{18(x-1)}+\frac{62\alpha_0}{27(x-1)}-\frac{d_1^2\alpha_0}{108(x-1)^2}-\frac{d_1\alpha_0}{54(x-1)^2}-\frac{\pi^2\alpha_0}{36(x-1)^2}+\frac{2\alpha_0}{27(x-1)^2}+\frac{113d_1^2\alpha_0}{108(x-1)^3}+$$
$$\frac{307d_1\alpha_0}{108(x-1)^3}+\frac{\pi^2\alpha_0}{18(x-1)^3}-\frac{325\alpha_0}{27(x-1)^3}+\frac{2911d_1^2\alpha_0}{432(x-1)^4}-\frac{1739d_1\alpha_0}{54(x-1)^4}-\frac{13\pi^2\alpha_0}{72(x-1)^4}+\frac{4099\alpha_0}{108(x-1)^4}+\frac{23\pi^2\alpha_0}{72}-\frac{4859\alpha_0}{108}+$$
$$\Big(-\frac{7d_1\alpha_0^3}{18}+\frac{7d_1\alpha_0^3}{18(x-1)^2}-\frac{7\alpha_0^3}{9(x-1)^2}+\frac{7\alpha_0^3}{9}+\frac{109d_1\alpha_0^2}{36}+\frac{13d_1\alpha_0^2}{36(x-1)}+\frac{11\alpha_0^2}{18(x-1)}-\frac{29d_1\alpha_0^2}{36(x-1)^2}+\frac{53\alpha_0^2}{18(x-1)^2}+\frac{67d_1\alpha_0^2}{36(x-1)^3}-$$
$$\frac{79\alpha_0^2}{18(x-1)^3}-\frac{121\alpha_0^2}{18}-\frac{305d_1\alpha_0}{18}-\frac{8\alpha_0}{3(x-2)}-\frac{38d_1\alpha_0}{9(x-1)}+\frac{10\alpha_0}{9(x-1)}+\frac{4d_1\alpha_0}{9(x-1)^2}-\frac{20\alpha_0}{9(x-1)^2}-\frac{2d_1\alpha_0}{9(x-1)^3}+\frac{82\alpha_0}{9(x-1)^3}+$$
$$\frac{217d_1\alpha_0}{18(x-1)^4}-\frac{271\alpha_0}{9(x-1)^4}+\frac{371\alpha_0}{9}+\frac{2035d_1^2}{432}-\frac{2035d_1}{108}+\frac{38d_1}{3(x-2)}-\frac{68}{3(x-2)}+\frac{63d_1^2}{16(x-1)}-\frac{161d_1}{12(x-1)}-\frac{\pi^2}{8(x-1)}+\frac{3}{2(x-1)}-$$
$$\frac{76d_1}{9(x-2)^2}+\frac{152}{9(x-2)^2}-\frac{19d_1^2}{54(x-1)^2}+\frac{323d_1}{108(x-1)^2}+\frac{\pi^2}{36(x-1)^2}-\frac{215}{108(x-1)^2}-\frac{19d_1^2}{54(x-1)^3}+\frac{605d_1}{108(x-1)^3}+\frac{\pi^2}{36(x-1)^3}-$$
$$\frac{1643}{108(x-1)^3}+\frac{63d_1^2}{16(x-1)^4}-\frac{50d_1}{3(x-1)^4}-\frac{\pi^2}{8(x-1)^4}+\frac{8}{(x-1)^4}+\frac{2035d_1^2}{432(x-1)^5}-\frac{895d_1}{27(x-1)^5}-\frac{25\pi^2}{72(x-1)^5}+\frac{5665}{108(x-1)^5}-\frac{25\pi^2}{72}+$$
$$\frac{1855}{108}\Big)H(0;\alpha_0)+\Big(-\frac{7}{36}d_1^2\alpha_0^3+\frac{7d_1\alpha_0^3}{18}+\frac{7d_1^2\alpha_0^3}{36(x-1)^2}-\frac{7d_1\alpha_0^3}{18(x-1)^2}+\frac{109d_1^2\alpha_0^2}{72}-\frac{121d_1\alpha_0^2}{36}+\frac{13d_1^2\alpha_0^2}{72(x-1)}+\frac{11d_1\alpha_0^2}{36(x-1)}-$$
$$\frac{29d_1^2\alpha_0^2}{72(x-1)^2}+\frac{53d_1\alpha_0^2}{36(x-1)^2}+\frac{67d_1^2\alpha_0^2}{72(x-1)^3}-\frac{79d_1\alpha_0^2}{36(x-1)^3}-\frac{305d_1^2\alpha_0}{36}+\frac{371d_1\alpha_0}{18}-\frac{4d_1\alpha_0}{3(x-2)}-\frac{19d_1^2\alpha_0}{9(x-1)}+\frac{5d_1\alpha_0}{9(x-1)}+\frac{2d_1^2\alpha_0}{9(x-1)^2}-$$
$$\frac{10d_1\alpha_0}{9(x-1)^2}-\frac{d_1^2\alpha_0}{9(x-1)^3}+\frac{41d_1\alpha_0}{9(x-1)^3}+\frac{217d_1^2\alpha_0}{36(x-1)^4}-\frac{271d_1\alpha_0}{18(x-1)^4}+\frac{515d_1^2}{72}-\frac{635d_1}{36}+\frac{4d_1}{3(x-2)}+\frac{139d_1^2}{72(x-1)}-\frac{31d_1}{36(x-1)}-\frac{d_1^2}{72(x-1)^2}+$$
$$\frac{d_1}{36(x-1)^2}-\frac{59d_1^2}{72(x-1)^3}-\frac{85d_1}{36(x-1)^3}-\frac{217d_1^2}{36(x-1)^4}+\frac{271d_1}{18(x-1)^4}\Big)H(1;\alpha_0)+\Big(\frac{4\alpha_0^3}{3(x-1)^2}-\frac{4\alpha_0^3}{3}+\frac{2\alpha_0^2}{3(x-1)}-\frac{10\alpha_0^2}{3(x-1)^2}+$$
$$\frac{14\alpha_0^2}{3(x-1)^3}+\frac{26\alpha_0^2}{3}-\frac{16\alpha_0}{3(x-1)}+\frac{8\alpha_0}{3(x-1)^2}-\frac{16\alpha_0}{3(x-1)^3}+\frac{52\alpha_0}{3(x-1)^4}-\frac{92\alpha_0}{3}+\frac{205d_1}{18}+\frac{16}{x-2}+\frac{15d_1}{2(x-1)}-\frac{7}{x-1}-\frac{32}{3(x-2)^2}-$$
$$\frac{10d_1}{9(x-1)^2}+\frac{2}{9(x-1)^2}-\frac{10d_1}{9(x-1)^3}+\frac{62}{9(x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{13}{(x-1)^4}+\frac{205d_1}{18(x-1)^5}-\frac{415}{9(x-1)^5}-\frac{205}{9}\Big)H(0,0;\alpha_0)+\Big(-$$
$$\frac{15d_1}{2(x-1)}+\frac{10d_1}{9(x-1)^2}+\frac{10d_1}{9(x-1)^3}-\frac{15d_1}{2(x-1)^4}-\frac{205d_1}{18(x-1)^5}-\frac{205d_1}{18}-\frac{16}{x-2}+\frac{7}{x-1}+\frac{32}{3(x-2)^2}-\frac{2}{9(x-1)^2}-\frac{62}{9(x-1)^3}+$$
$$\frac{13}{(x-1)^4}-\frac{8\pi^2}{3(x-1)^5}+\frac{415}{9(x-1)^5}-\frac{4\pi^2}{3}+\frac{205}{9}\Big)H(0,0;x)+\Big(-\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+$$
$$\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+\frac{205d_1^2}{36}-\frac{205d_1}{18}+\frac{8d_1}{x-2}+\frac{15d_1^2}{4(x-1)}-\frac{7d_1}{2(x-1)}-$$
$$\frac{16d_1}{3(x-2)^2}-\frac{5d_1^2}{9(x-1)^2}+\frac{d_1}{9(x-1)^2}-\frac{5d_1^2}{9(x-1)^3}+\frac{31d_1}{9(x-1)^3}+\frac{15d_1^2}{4(x-1)^4}-\frac{13d_1}{2(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}-\frac{415d_1}{18(x-1)^5}\Big)H(0,1;\alpha_0)+$$
$$\Big(\frac{4\pi^2d_1}{3(x-1)^5}+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}-\frac{8}{x-2}+\frac{5}{x-1}+\frac{16}{3(x-2)^2}-\frac{2}{3(x-1)^2}-\frac{16}{3(x-2)^3}+$$
$$\frac{10}{3(x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3(x-1)^5}-\frac{25}{3}\Big)H(0;\alpha_0)+\Big(-\frac{8d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}-8\Big)H(0,0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+$$
$$4d_1^2+\frac{4d_1}{(x-1)^5}-4d_1\Big)H(0,1;\alpha_0)-\frac{8\pi^2}{3(x-1)^5}\Big)H(0,1;x)+\Big(\frac{\pi^2d_1}{(x-1)^5}-\pi^2d_1-\frac{\pi^2}{(x-1)^5}+\pi^2\Big)H(0,2;x)+\Big(-$$
$$\frac{2d_1\alpha_0^3}{3}+\frac{2d_1\alpha_0^3}{3(x-1)^2}+\frac{13d_1\alpha_0^2}{3}+\frac{d_1\alpha_0^2}{3(x-1)}-\frac{5d_1\alpha_0^2}{3(x-1)^2}+\frac{7d_1\alpha_0^2}{3(x-1)^3}-\frac{46d_1\alpha_0}{3}-\frac{8d_1\alpha_0}{3(x-1)}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{8d_1\alpha_0}{3(x-1)^3}+\frac{26d_1\alpha_0}{3(x-1)^4}+$$
$$\frac{35d_1}{3}+\frac{7d_1}{3(x-1)}-\frac{d_1}{3(x-1)^2}+\frac{d_1}{3(x-1)^3}-\frac{26d_1}{3(x-1)^4}\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{x-1}-\frac{d_1^2}{(x-1)^2}+\frac{4d_1^2}{9(x-1)^3}-\frac{d_1^2}{4(x-1)^4}+\frac{205d_1^2}{36(x-1)^5}+$$
$$\frac{46d_1}{3(x-2)}-\frac{46d_1}{3(x-1)}-\frac{52d_1}{9(x-2)^2}+\frac{40d_1}{9(x-1)^2}+\frac{28d_1}{9(x-2)^3}-\frac{98d_1}{9(x-1)^3}+\frac{13d_1}{6(x-1)^4}+\frac{4\pi^2d_1}{3(x-1)^5}-\frac{415d_1}{18(x-1)^5}-\frac{80}{3(x-2)}-\frac{43}{6(x-1)}+$$
$$\frac{56}{9(x-2)^2}+\frac{299}{18(x-1)^2}-\frac{56}{9(x-2)^3}+\frac{23}{6(x-1)^3}+\frac{203}{6(x-1)^4}-\frac{5\pi^2}{2(x-1)^5}+\frac{35}{6(x-1)^5}-\frac{\pi^2}{6}-\frac{35}{6}\Big)H(1,0;x)+\Big(-\frac{1}{3}d_1^2\alpha_0^3+$$
$$\frac{d_1^2\alpha_0^3}{3(x-1)^2}+\frac{13d_1^2\alpha_0^2}{6}+\frac{d_1^2\alpha_0^2}{6(x-1)}-\frac{5d_1^2\alpha_0^2}{6(x-1)^2}+\frac{7d_1^2\alpha_0^2}{6(x-1)^3}-\frac{23d_1^2\alpha_0}{3}-\frac{4d_1^2\alpha_0}{3(x-1)}+\frac{2d_1^2\alpha_0}{3(x-1)^2}-\frac{4d_1^2\alpha_0}{3(x-1)^3}+\frac{13d_1^2\alpha_0}{3(x-1)^4}+$$
$$\frac{35d_1^2}{6}+\frac{7d_1^2}{6(x-1)}-\frac{d_1^2}{6(x-1)^2}+\frac{d_1^2}{6(x-1)^3}-\frac{13d_1^2}{3(x-1)^4}\Big)H(1,1;\alpha_0)+H(0,c_1(\alpha_0);x)\Big(-\frac{d_1\alpha_0^4}{4}+\frac{d_1\alpha_0^4}{4(x-1)}-\frac{\alpha_0^4}{2(x-1)}+$$
$$\frac{\alpha_0^4}{2}+\frac{13d_1\alpha_0^3}{9}-\frac{d_1\alpha_0^3}{x-1}+\frac{10\alpha_0^3}{3(x-1)}+\frac{4d_1\alpha_0^3}{9(x-1)^2}-\frac{11\alpha_0^3}{9(x-1)^2}-\frac{29\alpha_0^3}{9}-\frac{23d_1\alpha_0^2}{6}-\frac{2\alpha_0^2}{3(x-2)}+\frac{3d_1\alpha_0^2}{2(x-1)}-\frac{53\alpha_0^2}{6(x-1)}-\frac{4d_1\alpha_0^2}{3(x-1)^2}+$$
$$\frac{37\alpha_0^2}{6(x-1)^2}+\frac{d_1\alpha_0^2}{(x-1)^3}-\frac{19\alpha_0^2}{6(x-1)^3}+\frac{59\alpha_0^2}{6}+\frac{25d_1\alpha_0}{3}+\frac{4\alpha_0}{x-2}-\frac{d_1\alpha_0}{x-1}+\frac{14\alpha_0}{x-1}-\frac{8\alpha_0}{3(x-2)^2}+\frac{4d_1\alpha_0}{3(x-1)^2}-\frac{38\alpha_0}{3(x-1)^2}-\frac{2d_1\alpha_0}{(x-1)^3}+$$
$$\frac{40\alpha_0}{3(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{37\alpha_0}{3(x-1)^4}-\frac{73\alpha_0}{3}-\frac{205d_1}{36}+\Big(\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+$$
$$\frac{4\alpha_0^2}{(x-1)^3}-24\alpha_0^2-\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}+32\alpha_0-\frac{16}{x-2}+\frac{2}{x-1}+\frac{32}{3(x-2)^2}+\frac{8}{3(x-1)^2}-\frac{32}{3(x-2)^3}+$$
$$\frac{4}{(x-1)^3}+\frac{8}{(x-1)^4}-\frac{50}{3}\Big)H(0;\alpha_0)+\Big(-d_1\alpha_0^4+\frac{d_1\alpha_0^4}{x-1}+\frac{16d_1\alpha_0^3}{3}-\frac{4d_1\alpha_0^3}{x-1}+\frac{4d_1\alpha_0^3}{3(x-1)^2}-12d_1\alpha_0^2+\frac{6d_1\alpha_0^2}{x-1}-\frac{4d_1\alpha_0^2}{(x-1)^2}+$$
$$\frac{2d_1\alpha_0^2}{(x-1)^3}+16d_1\alpha_0-\frac{4d_1\alpha_0}{x-1}+\frac{4d_1\alpha_0}{(x-1)^2}-\frac{4d_1\alpha_0}{(x-1)^3}+\frac{4d_1\alpha_0}{(x-1)^4}-\frac{25d_1}{3}-\frac{8d_1}{x-2}+\frac{d_1}{x-1}+\frac{16d_1}{3(x-2)^2}+\frac{4d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+$$

$$\frac{2d_1}{(x-1)^3} + \frac{4 d_1}{(x-1)^4}\Big) H(1;\alpha_0) + \Big(\frac{16}{(x-1)^5} - 16\Big) H(0,0;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} - 8d_1\Big) H(0,1;\alpha_0) + \Big(\frac{8d_1}{(x-1)^5} -$$

$$8d_1\Big) H(1,0;\alpha_0) + \Big(\frac{4d_1^2}{(x-1)^5} - 4d_1^2\Big) H(1,1;\alpha_0) - \frac{32d_1}{3(x-2)} + \frac{70}{3(x-2)} + \frac{35d_1}{12(x-1)} - \frac{5}{6(x-1)} + \frac{28d_1}{9(x-2)^2} - \frac{32}{9(x-2)^2} +$$

$$\frac{28d_1}{9(x-1)^2} - \frac{80}{9(x-1)^2} - \frac{28d_1}{9(x-2)^3} + \frac{56}{9(x-2)^3} + \frac{5d_1}{(x-1)^3} - \frac{14}{(x-1)^3} + \frac{4d_1}{(x-1)^4} - \frac{43}{2(x-1)^4} - \frac{\pi^2}{6(x-1)^5} - \frac{35}{6(x-1)^5} + \frac{\pi^2}{6} +$$

$$\frac{415}{18}\Big) + H(c_1(\alpha_0);x)\Big(\frac{d_1^2\alpha_0^4}{16} - \frac{d_1\alpha_0^4}{4} - \frac{d_1^2\alpha_0^4}{16(x-1)} + \frac{d_1\alpha_0^4}{4(x-1)} + \frac{\pi^2\alpha_0^4}{24(x-1)} - \frac{\alpha_0^4}{4(x-1)} - \frac{\pi^2\alpha_0^4}{24} + \frac{\alpha_0^4}{4} - \frac{43d_1^2\alpha_0^3}{108} + \frac{43d_1\alpha_0^3}{27} +$$

$$\frac{d_1^2\alpha_0^3}{4(x-1)} - \frac{16d_1\alpha_0^3}{9(x-1)} - \frac{\pi^2\alpha_0^3}{6(x-1)} + \frac{23\alpha_0^3}{9(x-1)} - \frac{4d_1^2\alpha_0^3}{27(x-1)^2} + \frac{53d_1\alpha_0^3}{54(x-1)^2} + \frac{\pi^2\alpha_0^3}{18(x-1)^2} - \frac{37\alpha_0^3}{27(x-1)^2} + \frac{2\pi^2\alpha_0^3}{9} - \frac{43\alpha_0^3}{27} + \frac{95d_1^2\alpha_0^2}{72} -$$

$$\frac{95d_1\alpha_0^2}{18} + \frac{13d_1\alpha_0^2}{18(x-2)} - \frac{13\alpha_0^2}{9(x-2)} - \frac{3d_1^2\alpha_0^2}{8(x-1)} + \frac{16d_1\alpha_0^2}{3(x-1)} + \frac{\pi^2\alpha_0^2}{4(x-1)} - \frac{59\alpha_0^2}{6(x-1)} + \frac{4d_1^2\alpha_0^2}{9(x-1)^2} - \frac{173d_1\alpha_0^2}{36(x-1)^2} - \frac{\pi^2\alpha_0^2}{6(x-1)^2} + \frac{59\alpha_0^2}{6(x-1)^2} -$$

$$\frac{d_1^2\alpha_0^2}{2(x-1)^3} + \frac{139d_1\alpha_0^2}{36(x-1)^3} + \frac{\pi^2\alpha_0^2}{12(x-1)^3} - \frac{56\alpha_0^2}{9(x-1)^3} - \frac{\pi^2\alpha_0^2}{2} + \frac{46\alpha_0^2}{9} - \frac{205d_1^2\alpha_0}{36} + \frac{205d_1\alpha_0}{9} - \frac{17d_1\alpha_0}{3(x-2)} + \frac{10\alpha_0}{x-2} + \frac{d_1^2\alpha_0}{4(x-1)} -$$

$$\frac{127d_1\alpha_0}{9(x-1)} - \frac{\pi^2\alpha_0}{6(x-1)} + \frac{1247\alpha_0}{36(x-1)} + \frac{38d_1\alpha_0}{9(x-2)^2} - \frac{76\alpha_0}{9(x-2)^2} - \frac{4d_1^2\alpha_0}{9(x-1)^2} + \frac{34d_1\alpha_0}{3(x-1)^2} + \frac{\pi^2\alpha_0}{6(x-1)^2} - \frac{565\alpha_0}{18(x-1)^2} + \frac{d_1^2\alpha_0}{(x-1)^3} -$$

$$\frac{146d_1\alpha_0}{9(x-1)^3} - \frac{\pi^2\alpha_0}{6(x-1)^3} + \frac{1495\alpha_0}{36(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{505d_1\alpha_0}{18(x-1)^4} + \frac{\pi^2\alpha_0}{6(x-1)^4} - \frac{803\alpha_0}{18(x-1)^4} + \frac{2\pi^2\alpha_0}{3} - \frac{377\alpha_0}{18} + \frac{2035d_1^2}{432} - \frac{2035d_1}{108} +$$

$$\Big(\frac{d_1\alpha_0^4}{2} - \frac{d_1\alpha_0^4}{2(x-1)} + \frac{\alpha_0^4}{x-1} - \alpha_0^4 - \frac{26d_1\alpha_0^3}{9} + \frac{2d_1\alpha_0^3}{x-1} - \frac{20\alpha_0^3}{3(x-1)} - \frac{8d_1\alpha_0^3}{9(x-1)^2} + \frac{28\alpha_0^3}{9(x-1)^2} + \frac{52\alpha_0^3}{9} + \frac{23d_1\alpha_0^2}{3} + \frac{4\alpha_0^2}{3(x-2)} -$$

$$\frac{3d_1\alpha_0^2}{x-1} + \frac{18\alpha_0^2}{x-1} + \frac{8d_1\alpha_0^2}{3(x-1)^2} - \frac{14\alpha_0^2}{(x-1)^2} - \frac{2d_1\alpha_0^2}{(x-1)^3} + \frac{26\alpha_0^2}{3(x-1)^3} - \frac{46\alpha_0^2}{3} - \frac{50d_1\alpha_0}{3} - \frac{8\alpha_0}{x-2} + \frac{2d_1\alpha_0}{x-1} - \frac{92\alpha_0}{3(x-1)} + \frac{16\alpha_0}{3(x-2)^2} -$$

$$\frac{8d_1\alpha_0}{3(x-1)^2} + \frac{80\alpha_0}{3(x-1)^2} + \frac{4d_1\alpha_0}{(x-1)^3} - \frac{88\alpha_0}{3(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{100\alpha_0}{3(x-1)^4} + \frac{100\alpha_0}{3} + \frac{205d_1}{18} + \frac{16}{x-2} + \frac{15d_1}{2(x-1)} - \frac{7}{x-1} - \frac{32}{3(x-2)^2} -$$

$$\frac{10d_1}{9(x-1)^2} + \frac{2}{9(x-1)^2} - \frac{10d_1}{9(x-1)^3} + \frac{62}{9(x-1)^3} + \frac{15d_1}{2(x-1)^4} - \frac{13}{(x-1)^4} + \frac{205d_1}{18(x-1)^5} - \frac{415}{9(x-1)^5} - \frac{205}{9}\Big) H(0;\alpha_0) + \Big(\frac{d_1^2\alpha_0^4}{4} -$$

$$\frac{d_1\alpha_0^4}{2} - \frac{d_1^2\alpha_0^4}{4(x-1)} + \frac{d_1\alpha_0^4}{2(x-1)} - \frac{13d_1^2\alpha_0^3}{9} + \frac{26d_1\alpha_0^3}{9} + \frac{d_1^2\alpha_0^3}{x-1} - \frac{10d_1\alpha_0^3}{3(x-1)} - \frac{4d_1^2\alpha_0^3}{9(x-1)^2} + \frac{14d_1\alpha_0^3}{9(x-1)^2} + \frac{23d_1^2\alpha_0^2}{6} - \frac{23d_1\alpha_0^2}{3} + \frac{2d_1\alpha_0^2}{3(x-2)} -$$

$$\frac{3d_1^2\alpha_0^2}{2(x-1)} + \frac{9d_1\alpha_0^2}{x-1} + \frac{4d_1^2\alpha_0^2}{3(x-1)^2} - \frac{7d_1\alpha_0^2}{(x-1)^2} - \frac{d_1^2\alpha_0^2}{(x-1)^3} + \frac{13d_1\alpha_0^2}{3(x-1)^3} - \frac{25d_1^2\alpha_0}{3} + \frac{50d_1\alpha_0}{3} - \frac{4d_1\alpha_0}{x-2} + \frac{d_1^2\alpha_0}{x-1} - \frac{46d_1\alpha_0}{3(x-1)} + \frac{8d_1\alpha_0}{3(x-2)^2} -$$

$$\frac{4d_1^2\alpha_0}{3(x-1)^2} + \frac{40d_1\alpha_0}{3(x-1)^2} + \frac{2d_1^2\alpha_0}{(x-1)^3} - \frac{44d_1\alpha_0}{3(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{50d_1\alpha_0}{3(x-1)^4} + \frac{205d_1^2}{36} - \frac{205d_1}{18} + \frac{8d_1}{x-2} + \frac{15d_1^2}{4(x-1)} - \frac{7d_1}{2(x-1)} -$$

$$\frac{16d_1}{3(x-2)^2} - \frac{5d_1^2}{9(x-1)^2} + \frac{d_1}{9(x-1)^2} - \frac{5d_1^2}{9(x-1)^3} + \frac{31d_1}{9(x-1)^3} + \frac{15d_1^2}{4(x-1)^4} - \frac{13d_1}{2(x-1)^4} + \frac{205d_1^2}{36(x-1)^5} - \frac{415d_1}{18(x-1)^5}\Big) H(1;\alpha_0) + \Big(-$$

$$\frac{4\alpha_0^4}{x-1} + 4\alpha_0^4 + \frac{16\alpha_0^3}{x-1} - \frac{16\alpha_0^3}{3(x-1)^2} - \frac{64\alpha_0^3}{3} - \frac{24\alpha_0^2}{x-1} + \frac{16\alpha_0^2}{(x-1)^2} - \frac{8\alpha_0^2}{(x-1)^3} + 48\alpha_0^2 + \frac{16\alpha_0}{x-1} - \frac{16\alpha_0}{(x-1)^2} + \frac{16\alpha_0}{(x-1)^3} - \frac{16\alpha_0}{(x-1)^4} -$$

$$64\alpha_0 + \frac{12}{x-1} - \frac{8}{3(x-1)^2} - \frac{8}{3(x-1)^3} + \frac{12}{(x-1)^4} + \frac{100}{3(x-1)^5} + \frac{100}{3}\Big) H(0,0;\alpha_0) + \Big(2d_1\alpha_0^4 - \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} +$$

$$\frac{8d_1\alpha_0^3}{x-1} - \frac{8d_1\alpha_0^3}{3(x-1)^2} + 24d_1\alpha_0^2 - \frac{12d_1\alpha_0^2}{x-1} + \frac{8d_1\alpha_0^2}{(x-1)^2} - \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 + \frac{8d_1\alpha_0}{x-1} - \frac{8d_1\alpha_0}{(x-1)^2} + \frac{8d_1\alpha_0}{(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{50d_1}{3} +$$

$$\frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} - \frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5}\Big) H(0,1;\alpha_0) + \Big(2d_1\alpha_0^4 - \frac{2d_1\alpha_0^4}{x-1} - \frac{32d_1\alpha_0^3}{3} + \frac{8d_1\alpha_0^3}{x-1} - \frac{8d_1\alpha_0^3}{3(x-1)^2} +$$

$$24d_1\alpha_0^2 - \frac{12d_1\alpha_0^2}{x-1} + \frac{8d_1\alpha_0^2}{(x-1)^2} - \frac{4d_1\alpha_0^2}{(x-1)^3} - 32d_1\alpha_0 + \frac{8d_1\alpha_0}{x-1} - \frac{8d_1\alpha_0}{(x-1)^2} + \frac{8d_1\alpha_0}{(x-1)^3} - \frac{8d_1\alpha_0}{(x-1)^4} + \frac{50d_1}{3} + \frac{6d_1}{x-1} - \frac{4d_1}{3(x-1)^2} -$$

$$\frac{4d_1}{3(x-1)^3} + \frac{6d_1}{(x-1)^4} + \frac{50d_1}{3(x-1)^5}\Big) H(1,0;\alpha_0) + \Big(d_1^2\alpha_0^4 - \frac{d_1^2\alpha_0^4}{x-1} - \frac{16d_1^2\alpha_0^3}{3} + \frac{4d_1^2\alpha_0^3}{x-1} - \frac{4d_1^2\alpha_0^3}{3(x-1)^2} + 12d_1^2\alpha_0^2 - \frac{6d_1^2\alpha_0^2}{x-1} +$$

$$\frac{4d_1^2\alpha_0^2}{(x-1)^2} - \frac{2d_1^2\alpha_0^2}{(x-1)^3} - 16d_1^2\alpha_0 + \frac{4d_1^2\alpha_0}{x-1} - \frac{4d_1^2\alpha_0}{(x-1)^2} + \frac{4d_1^2\alpha_0}{(x-1)^3} - \frac{4d_1^2\alpha_0}{(x-1)^4} + \frac{25d_1^2}{3} + \frac{3d_1^2}{x-1} - \frac{2d_1^2}{3(x-1)^2} - \frac{2d_1^2}{3(x-1)^3} + \frac{3d_1^2}{(x-1)^4} +$$

$$\frac{25d_1^2}{3(x-1)^5}\Big) H(1,1;\alpha_0) + \frac{38d_1}{3(x-2)} - \frac{68}{3(x-2)} + \frac{63d_1^2}{16(x-1)} - \frac{161d_1}{12(x-1)} - \frac{\pi^2}{8(x-1)} + \frac{3}{2(x-1)} - \frac{76d_1}{9(x-2)^2} + \frac{152}{9(x-2)^2} -$$

$$\frac{19d_1^2}{54(x-1)^2} + \frac{323d_1}{108(x-1)^2} + \frac{\pi^2}{36(x-1)^2} - \frac{215}{108(x-1)^2} - \frac{19d_1^2}{54(x-1)^3} + \frac{605d_1}{108(x-1)^3} + \frac{\pi^2}{36(x-1)^3} - \frac{1643}{108(x-1)^3} + \frac{63d_1^2}{16(x-1)^4} -$$

$$\frac{50d_1}{3(x-1)^4} - \frac{\pi^2}{8(x-1)^4} + \frac{8}{(x-1)^4} + \frac{2035d_1^2}{432(x-1)^5} - \frac{895d_1}{27(x-1)^5} - \frac{25\pi^2}{72(x-1)^5} + \frac{5665}{108(x-1)^5} - \frac{25\pi^2}{72} + \frac{1855}{108}\Big) + \Big(-\frac{2\pi^2d_1^2}{3(x-1)^5} +$$

$$\frac{8\pi^2d_1}{3(x-1)^5} + \Big(\frac{4d_1^2}{x-1} - \frac{2d_1^2}{(x-1)^2} + \frac{4d_1^2}{3(x-1)^3} - \frac{d_1^2}{(x-1)^4} + \frac{25d_1^2}{3(x-1)^5} + \frac{8d_1}{x-2} - \frac{16d_1}{3(x-2)^2} - \frac{8d_1}{3(x-1)^2} + \frac{16d_1}{3(x-2)^3} - \frac{8d_1}{(x-1)^4} +$$

$$\frac{4}{x-2} - \frac{7}{2(x-1)} - \frac{8}{3(x-2)^2} + \frac{8}{3(x-2)^3} - \frac{1}{3(x-1)^3} - \frac{5}{(x-1)^4} - \frac{25}{3(x-1)^5} - \frac{25}{6}\Big) H(0;\alpha_0) + \Big(-\frac{16d_1}{(x-1)^5} + 8d_1 +$$

$$\frac{16}{(x-1)^5}\Big) H(0,0;\alpha_0) + \Big(-\frac{8d_1^2}{(x-1)^5} + 4d_1^2 + \frac{8d_1}{(x-1)^5}\Big) H(0,1;\alpha_0) - \frac{2\pi^2}{(x-1)^5} - \frac{2\pi^2}{3}\Big) H(1,1;x) + \Big(\frac{\pi^2d_1}{(x-1)^5} -$$

$$\frac{\pi^2}{2(x-1)^5} - \frac{3\pi^2}{2}\Big) H(1,2;x) + \Big(-\frac{4d_1^2}{x-1} + \frac{d_1^2}{(x-1)^2} - \frac{4d_1^2}{9(x-1)^3} + \frac{d_1^2}{4(x-1)^4} - \frac{205d_1^2}{36(x-1)^5} - \frac{46d_1}{3(x-2)} + \frac{46d_1}{3(x-1)} +$$

$$\frac{52d_1}{9(x-2)^2} - \frac{40d_1}{9(x-1)^2} - \frac{28d_1}{9(x-2)^3} + \frac{98d_1}{9(x-1)^3} - \frac{13d_1}{6(x-1)^4} + \frac{415d_1}{18(x-1)^5} + \Big(-\frac{8d_1}{x-1} + \frac{4d_1}{(x-1)^2} - \frac{8d_1}{3(x-1)^3} + \frac{2d_1}{(x-1)^4} -$$

$$\frac{50\ d_1}{3(x-1)^5}-\frac{16}{x-2}+\frac{32}{3(x-2)^2}+\frac{16}{3\ (x-1)^2}-\frac{32}{3(x-2)^3}+\frac{16}{(x-1)^4}\Big)H(0;\alpha_0)+\Big(-\ \frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3\ (x-1)^3}+\frac{d_1^2}{(x-1)^4}-$$

$$\frac{25d_1^2}{3(x-1)^5}-\frac{8\ d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16\ d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}\Big)\ H(1;\alpha_0)+\Big(\frac{16}{(x-1)^5}-16\Big)H(0,0;\alpha_0)+\Big(\frac{8\ d_1}{(x-1)^5}-$$

$$8d_1\Big)H(0,1;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-8\ d_1\Big)H(1,0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2\Big)\ H(1,1;\alpha_0)+\frac{80}{3(x-2)}+\frac{43}{6(x-1)}-$$

$$\frac{56}{9\ (x-2)^2}-\frac{299}{18(x-1)^2}+\frac{56}{9(x-2)^3}-\frac{23}{6\ (x-1)^3}-\frac{203}{6(x-1)^4}-\frac{\pi^2}{6(x-1)^5}-\frac{35}{6\ (x-1)^5}+\frac{\pi^2}{6}+\frac{35}{6}\Big)H(1,c_1(\alpha_0);x)+$$

$$\Big(2\ \pi^2-\frac{2\pi^2}{(x-1)^5}\Big)H(2,0;x)+\Big(\Big(-\frac{8\ d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16\ d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\frac{16}{x-2}-\frac{15}{2\ (x-1)}-\frac{32}{3(x-2)^2}-$$

$$\frac{1}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\ \frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-\frac{25}{2\ (x-1)^5}+\frac{25}{2}\Big)H(0;\alpha_0)+\Big(\frac{8}{(x-1)^5}-8\Big)\ H(0,0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-$$

$$4d_1\Big)H(0,1;\alpha_0)+\frac{\pi\ ^2}{3(x-1)^5}-\frac{\pi^2}{3}\Big)H(2,1;x)+\Big(-\frac{\pi^2\ d_1}{(x-1)^5}+\pi^2d_1+\frac{2\pi^2}{(x-1)^5}-2\pi^2\Big)\ H(2,2;x)+\Big(\frac{d_1\alpha_0^4}{2}-$$

$$\frac{d_1\alpha_0^4}{2\ (x-1)}+\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{26d_1\alpha_0^3}{9}+\frac{2d_1\ \alpha_0^3}{x-1}-\frac{41\alpha_0^3}{6(x-1)}-\frac{8d_1\alpha_0^3}{9\ (x-1)^2}+\frac{25\alpha_0^3}{9(x-1)^2}+\frac{107\alpha_0^3}{18}+\frac{23d_1\ \alpha_0^2}{3}+\frac{5\alpha_0^2}{3(x-2)}-\frac{3d_1\alpha_0^2}{x-1}+$$

$$\frac{221\ \alpha_0^2}{12(x-1)}+\frac{8d_1\alpha_0^2}{3(x-1)^2}-\frac{27\alpha_0^2}{2\ (x-1)^2}-\frac{2d_1\alpha_0^2}{(x-1)^3}+\frac{15\alpha_0^2}{2\ (x-1)^3}-\frac{197\alpha_0^2}{12}-\frac{50d_1\alpha_0}{3}-\frac{10\ \alpha_0}{x-2}+\frac{2d_1\alpha_0}{x-1}-\frac{181\alpha_0}{6(x-1)}+\frac{20\ \alpha_0}{3(x-2)^2}-$$

$$\frac{8d_1\alpha_0}{3(x-1)^2}+\frac{80\alpha_0}{3(x-1)^2}+\ \frac{4d_1\alpha_0}{(x-1)^3}-\frac{29\alpha_0}{(x-1)^3}-\frac{8d_1\ \alpha_0}{(x-1)^4}+\frac{29\alpha_0}{(x-1)^4}+\frac{223\alpha_0}{6}+\frac{205\ d_1}{18}+\Big(-\frac{4\alpha_0^4}{x-1}+4\alpha_0^4+\frac{16\ \alpha_0^3}{x-1}-\frac{16\alpha_0^3}{3(x-1)^2}-$$

$$\frac{64\alpha_0^3}{3}-\frac{24\ \alpha_0^2}{x-1}+\frac{16\alpha_0^2}{(x-1)^2}-\frac{8\alpha_0^2}{(x-1)^3}+48\ \alpha_0^2+\frac{16\alpha_0}{x-1}-\frac{16\alpha_0}{(x-1)^2}+\frac{16\ \alpha_0}{(x-1)^3}-\frac{16\alpha_0}{(x-1)^4}-64\alpha_0+\frac{12}{x-1}-\frac{8}{3\ (x-1)^2}-$$

$$\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3\ (x-1)^5}+\frac{100}{3}\Big)H(0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{2d_1\ \alpha_0^4}{x-1}-\frac{32d_1\alpha_0^3}{3}+\frac{8d_1\alpha_0^3}{x-1}-\frac{8\ d_1\alpha_0^3}{3(x-1)^2}+24d_1\alpha_0^2-$$

$$\frac{12d_1\alpha_0^2}{x-1}+\frac{8\ d_1\alpha_0^2}{(x-1)^2}-\frac{4d_1\alpha_0^2}{(x-1)^3}-32d_1\alpha_0+\frac{8\ d_1\alpha_0}{x-1}-\frac{8d_1\alpha_0}{(x-1)^2}+\frac{8d_1\ \alpha_0}{(x-1)^3}-\frac{8d_1\alpha_0}{(x-1)^4}+\frac{50d_1}{3}+\frac{6\ d_1}{x-1}-\frac{4d_1}{3(x-1)^2}-\frac{4d_1}{3(x-1)^3}+$$

$$\frac{6\ d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}\Big)H(1;\alpha_0)-\frac{16\ H(0,0;\alpha_0)}{(x-1)^5}-\frac{8d_1H(0,1;\alpha_0)}{(x-1)^5}-\frac{8d_1\ H(1,0;\alpha_0)}{(x-1)^5}-\frac{4d_1^2\ H(1,1;\alpha_0)}{(x-1)^5}+\frac{20}{x-2}+\frac{15d_1}{2\ (x-1)}-$$

$$\frac{49}{4(x-1)}-\frac{40}{3(x-2)^2}-\frac{10d_1}{9\ (x-1)^2}+\frac{5}{36(x-1)^2}-\frac{10d_1}{9(x-1)^3}+\frac{275}{36\ (x-1)^3}+\frac{15d_1}{2(x-1)^4}-\frac{6}{(x-1)^4}+\frac{205d_1}{18\ (x-1)^5}+\frac{\pi^2}{6(x-1)^5}-$$

$$\frac{725}{18\ (x-1)^5}-\frac{925}{36}\Big)H(c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{d_1\ \alpha_0^4}{4}-\frac{d_1\alpha_0^4}{4(x-1)}+\frac{\alpha_0^4}{2\ (x-1)}-\frac{\alpha_0^4}{2}-\frac{13d_1\alpha_0^3}{9}+\frac{d_1\ \alpha_0^3}{x-1}-\frac{3\alpha_0^3}{x-1}-\frac{4d_1\alpha_0^3}{9\ (x-1)^2}+$$

$$\frac{25\alpha_0^3}{18(x-1)^2}+\frac{61\alpha_0^3}{18}+\frac{23d_1\ \alpha_0^2}{6}-\frac{3d_1\alpha_0^2}{2(x-1)}+\frac{31\alpha_0^2}{4\ (x-1)}+\frac{4d_1\alpha_0^2}{3(x-1)^2}-\frac{71\alpha_0^2}{12\ (x-1)^2}-\frac{d_1\alpha_0^2}{(x-1)^3}+\frac{15\alpha_0^2}{4\ (x-1)^3}-\frac{131\alpha_0^2}{12}-\frac{25d_1\alpha_0}{3}+$$

$$\frac{d_1\ \alpha_0}{x-1}-\frac{13\alpha_0}{x-1}-\frac{4d_1\alpha_0}{3(x-1)^2}+\frac{35\ \alpha_0}{3(x-1)^2}+\frac{2d_1\alpha_0}{(x-1)^3}-\frac{12\ \alpha_0}{(x-1)^3}-\frac{4d_1\alpha_0}{(x-1)^4}+\frac{29\alpha_0}{2\ (x-1)^4}+\frac{169\alpha_0}{6}+\frac{205d_1}{36}+\Big(-\frac{2\ \alpha_0^4}{x-1}+2\alpha_0^4+$$

$$\frac{8\alpha_0^3}{x-1}-\frac{8\alpha_0^3}{3\ (x-1)^2}-\frac{32\alpha_0^3}{3}-\frac{12\alpha_0^2}{x-1}+\frac{8\ \alpha_0^2}{(x-1)^2}-\frac{4\alpha_0^2}{(x-1)^3}+24\alpha_0^2+\frac{8\ \alpha_0}{x-1}-\frac{8\alpha_0}{(x-1)^2}+\frac{8\alpha_0}{(x-1)^3}-\frac{8\ \alpha_0}{(x-1)^4}-32\alpha_0+\frac{16}{x-2}-$$

$$\frac{2}{x-1}-\frac{32}{3\ (x-2)^2}-\frac{8}{3(x-1)^2}+\frac{32}{3\ (x-2)^3}-\frac{4}{(x-1)^3}-\frac{8}{(x-1)^4}+\frac{50}{3}\Big)\ H(0;\alpha_0)+\Big(d_1\alpha_0^4-\frac{d_1\alpha_0^4}{x-1}-\frac{16d_1\alpha_0^3}{3}+\ \frac{4d_1\alpha_0^3}{x-1}-$$

$$\frac{4d_1\alpha_0^3}{3(x-1)^2}+12d_1\ \alpha_0^2-\frac{6d_1\alpha_0^2}{x-1}+\frac{4d_1\alpha_0^2}{(x-1)^2}-\frac{2d_1\ \alpha_0^2}{(x-1)^3}-16d_1\alpha_0+\frac{4d_1\alpha_0}{x-1}-\frac{4d_1\ \alpha_0}{(x-1)^2}+\frac{4d_1\alpha_0}{(x-1)^3}-\frac{4d_1\ \alpha_0}{(x-1)^4}+\frac{25d_1}{3}+\frac{8\ d_1}{x-2}-$$

$$\frac{d_1}{x-1}-\frac{16d_1}{3(x-2)^2}-\frac{4d_1}{3\ (x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{2d_1}{(x-1)^3}-\frac{4\ d_1}{(x-1)^4}\Big)H(1;\alpha_0)+\frac{32d_1}{3(x-2)}-\frac{82}{3\ (x-2)}-\frac{35d_1}{12(x-1)}+\frac{73}{12(x-1)}-$$

$$\frac{28d_1}{9\ (x-2)^2}+\frac{56}{9(x-2)^2}-\frac{28d_1}{9(x-1)^2}+\frac{323}{36\ (x-1)^2}+\frac{28d_1}{9(x-2)^3}-\frac{56}{9(x-2)^3}-\frac{5\ d_1}{(x-1)^3}+\frac{53}{4(x-1)^3}-\frac{4d_1}{(x-1)^4}+\frac{29}{2\ (x-1)^4}-$$

$$\frac{725}{36}\Big)\ H(c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{100}{3}+\frac{12}{x-1}-\frac{8}{3\ (x-1)^2}-\frac{8}{3(x-1)^3}+\frac{12}{(x-1)^4}+\frac{100}{3(x-1)^5}\ \Big)H(0,0,0;\alpha_0)+\Big(-$$

$$\frac{100}{3}-\frac{12}{x-1}+\frac{8}{3\ (x-1)^2}+\frac{8}{3(x-1)^3}-\frac{12}{(x-1)^4}-\frac{100}{3(x-1)^5}\ \Big)H(0,0,0;x)+\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\ (x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+$$

$$\frac{50\ d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,0,1;\alpha_0)+\Big(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{12}{(x-1)^5}-12\Big)H(0;\alpha_0)\ H(0,0,1;x)+\Big(-\frac{\alpha_0^4}{x-1}+\alpha_0^4+$$

$$\frac{4\alpha_0^3}{x-1}-\frac{4\ \alpha_0^3}{3(x-1)^2}-\frac{16\alpha_0^3}{3}-\frac{6\alpha_0^2}{x-1}+\frac{4\ \alpha_0^2}{(x-1)^2}-\frac{2\alpha_0^2}{(x-1)^3}+12\alpha_0^2+\frac{4\ \alpha_0}{x-1}-\frac{4\alpha_0}{(x-1)^2}+\frac{4\alpha_0}{(x-1)^3}-\frac{4\ \alpha_0}{(x-1)^4}-16\alpha_0+\Big(\frac{8}{(x-1)^5}-$$

$$8\Big)\ H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)\ H(1;\alpha_0)-\frac{8}{x-2}+\frac{4}{x-1}+\frac{16}{3(x-2)^2}+\frac{2}{3\ (x-1)^2}-\frac{16}{3(x-2)^3}+\frac{4}{3\ (x-1)^3}+\frac{7}{(x-1)^4}+$$

$$\frac{25}{3(x-1)^5}\Big)\ H(0,0,c_1(\alpha_0);x)+\Big(\frac{6d_1}{x-1}-\frac{4d_1}{3\ (x-1)^2}-\frac{4d_1}{3(x-1)^3}+\frac{6d_1}{(x-1)^4}+\frac{50\ d_1}{3(x-1)^5}+\frac{50d_1}{3}\Big)H(0,1,0;\alpha_0)+\Big(-$$

$$\frac{8\ d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16\ d_1}{3(x-2)^3}+\frac{8\ d_1}{(x-1)^4}+\frac{8}{x-2}-\frac{5}{x-1}-\frac{16}{3\ (x-2)^2}+\frac{2}{3(x-1)^2}+\frac{16}{3(x-2)^3}-\frac{10}{3\ (x-1)^3}-\frac{3}{(x-1)^4}-$$

$$\frac{25}{3(x-1)^5}+\frac{25}{3}\Big)\ H(0,1,0;x)+\Big(\frac{3d_1^2}{x-1}-\frac{2d_1^2}{3(x-1)^2}-\frac{2\ d_1^2}{3(x-1)^3}+\frac{3d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\ \frac{25d_1^2}{3}\Big)H(0,1,1;\alpha_0)+$$

$$\Big(\frac{4d_1^2}{(x-1)^5}-4d_1^2-\frac{12d_1}{(x-1)^5}+4d_1+\frac{16}{(x-1)^5}\Big)H(0;\alpha_0)\,H(0,1,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-$$

$$\frac{8d_1}{(x-1)^4}+\Big(-\frac{8d_1}{(x-1)^5}+8d_1+\frac{8}{(x-1)^5}-8\Big)H(0;\alpha_0)+\Big(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)-\frac{8}{x-2}+$$

$$\frac{5}{x-1}+\frac{16}{3(x-2)^2}-\frac{2}{3(x-1)^2}-\frac{16}{3(x-2)^3}+\frac{10}{3(x-1)^3}+\frac{3}{(x-1)^4}+\frac{25}{3(x-1)^5}-\frac{25}{3}\Big)H(0,1,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+$$

$$4d_1+\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)H(0,2,1;x)+\Big(\frac{2\alpha_0^4}{x-1}-2\alpha_0^4-\frac{8\alpha_0^3}{x-1}+\frac{8\alpha_0^3}{3(x-1)^2}+\frac{32\alpha_0^3}{3}+\frac{12\alpha_0^2}{x-1}-\frac{8\alpha_0^2}{(x-1)^2}+\frac{4\alpha_0^2}{(x-1)^3}-$$

$$24\alpha_0^2-\frac{8\alpha_0}{x-1}+\frac{8\alpha_0}{(x-1)^2}-\frac{8\alpha_0}{(x-1)^3}+\frac{8\alpha_0}{(x-1)^4}+32\alpha_0-16H(0;\alpha_0)-8d_1\,H(1;\alpha_0)-\frac{20}{x-2}+\frac{11}{2(x-1)}+\frac{40}{3(x-2)^2}+$$

$$\frac{8}{3(x-1)^2}-\frac{40}{3(x-2)^3}+\frac{13}{3(x-1)^3}+\frac{13}{(x-1)^4}+\frac{25}{3(x-1)^5}-\frac{25}{2}\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{4\alpha_0^3}{x-1}+$$

$$\frac{4\alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+\frac{6\alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\alpha_0}{(x-1)^4}+16\alpha_0+\Big(\frac{8}{(x-1)^5}-$$

$$8\Big)H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{16}{x-2}-\frac{13}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{5}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{3}{(x-1)^3}-\frac{25}{2(x-1)^4}-$$

$$\frac{25}{2(x-1)^5}+\frac{25}{6}\Big)H(0,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{8d_1}{x-1}-\frac{4d_1}{(x-1)^2}+\frac{8d_1}{3(x-1)^3}-\frac{2d_1}{(x-1)^4}+\frac{50d_1}{3(x-1)^5}+\frac{16}{x-2}-\frac{32}{3(x-2)^2}-$$

$$\frac{16}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{16}{(x-1)^4}\Big)H(1,0,0;x)+\Big(\frac{4d_1^2}{(x-1)^5}-\frac{12d_1}{(x-1)^5}+\frac{12}{(x-1)^5}-4\Big)H(0;\alpha_0)\,H(1,0,1;x)+$$

$$\Big(\Big(\frac{16}{(x-1)^5}-\frac{8d_1}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(\frac{8d_1}{(x-1)^5}-\frac{4d_1^2}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{4}{x-2}-\frac{7}{2(x-1)}-\frac{8}{3(x-2)^2}+\frac{8}{3(x-2)^3}-$$

$$\frac{1}{3(x-1)^3}-\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{6}\Big)H(1,0,c_1(\alpha_0);x)+\Big(-\frac{4d_1^2}{x-1}+\frac{2d_1^2}{(x-1)^2}-\frac{4d_1^2}{3(x-1)^3}+\frac{d_1^2}{(x-1)^4}-\frac{25d_1^2}{3(x-1)^5}-$$

$$\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}-\frac{4}{x-2}+\frac{7}{2(x-1)}+\frac{8}{3(x-2)^2}-\frac{8}{3(x-2)^3}+\frac{1}{3(x-1)^3}+\frac{5}{(x-1)^4}+$$

$$\frac{25}{3(x-1)^5}+\frac{25}{6}\Big)H(1,1,0;x)+\Big(\frac{12d_1^2}{(x-1)^5}-4d_1^2-\frac{24d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+4\Big)H(0;\alpha_0)\,H(1,1,1;x)+\Big(\frac{4d_1^2}{x-1}-$$

$$\frac{2d_1^2}{(x-1)^2}+\frac{4d_1^2}{3(x-1)^3}-\frac{d_1^2}{(x-1)^4}+\frac{25d_1^2}{3(x-1)^5}+\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\Big(-\frac{16d_1}{(x-1)^5}+8d_1+$$

$$\frac{16}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(-\frac{8d_1^2}{(x-1)^5}+4d_1^2+\frac{8d_1}{(x-1)^5}\Big)H(1;\alpha_0)+\frac{4}{x-2}-\frac{7}{2(x-1)}-\frac{8}{3(x-2)^2}+\frac{8}{3(x-2)^3}-\frac{1}{3(x-1)^3}-$$

$$\frac{5}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{6}\Big)H(1,1,c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+6\Big)H(0;\alpha_0)\,H(1,2,1;x)+\Big(-\frac{8d_1}{x-1}+$$

$$\frac{4d_1}{(x-1)^2}-\frac{8d_1}{3(x-1)^3}+\frac{2d_1}{(x-1)^4}-\frac{50d_1}{3(x-1)^5}+\Big(\frac{8d_1}{(x-1)^5}-16\Big)H(0;\alpha_0)+\Big(\frac{4d_1^2}{(x-1)^5}-8d_1\Big)H(1;\alpha_0)-\frac{20}{x-2}+\frac{7}{2(x-1)}+$$

$$\frac{40}{3(x-2)^2}+\frac{16}{3(x-1)^2}-\frac{40}{3(x-2)^3}+\frac{1}{3(x-1)^3}+\frac{21}{(x-1)^4}+\frac{25}{3(x-1)^5}+\frac{25}{6}\Big)H(1,c_1(\alpha_0),c_1(\alpha_0);x)+\Big(-\frac{4d_1}{(x-1)^5}+$$

$$4d_1+\frac{4}{(x-1)^5}-4\Big)H(0;\alpha_0)\,H(2,0,1;x)+\Big(-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\Big(\frac{8}{(x-1)^5}-$$

$$8\Big)H(0;\alpha_0)+\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{16}{x-2}-\frac{15}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{1}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-$$

$$\frac{25}{2(x-1)^5}+\frac{25}{2}\Big)H(2,0,c_1(\alpha_0);x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}-\frac{16}{x-2}+\frac{15}{2(x-1)}+$$

$$\frac{32}{3(x-2)^2}+\frac{1}{3(x-1)^2}-\frac{32}{3(x-2)^3}+\frac{5}{(x-1)^3}+\frac{17}{2(x-1)^4}+\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(2,1,0;x)+\Big(-\frac{4d_1}{(x-1)^5}+4d_1-\frac{2}{(x-1)^5}+$$

$$2\Big)H(0;\alpha_0)H(2,1,1;x)+\Big(-\frac{8d_1}{x-2}+\frac{16d_1}{3(x-2)^2}+\frac{8d_1}{3(x-1)^2}-\frac{16d_1}{3(x-2)^3}+\frac{8d_1}{(x-1)^4}+\Big(\frac{8}{(x-1)^5}-8\Big)H(0;\alpha_0)+$$

$$\Big(\frac{4d_1}{(x-1)^5}-4d_1\Big)H(1;\alpha_0)+\frac{16}{x-2}-\frac{15}{2(x-1)}-\frac{32}{3(x-2)^2}-\frac{1}{3(x-1)^2}+\frac{32}{3(x-2)^3}-\frac{5}{(x-1)^3}-\frac{17}{2(x-1)^4}-\frac{25}{2(x-1)^5}+$$

$$\frac{25}{2}\Big)H(2,1,c_1(\alpha_0);x)+\Big(\frac{4d_1}{(x-1)^5}-4d_1-\frac{8}{(x-1)^5}+8\Big)H(0;\alpha_0)H(2,2,1;x)+\Big(\frac{8d_1}{x-2}-\frac{16d_1}{3(x-2)^2}-\frac{8d_1}{3(x-1)^2}+$$

$$\frac{16d_1}{3(x-2)^3}-\frac{8d_1}{(x-1)^4}+\Big(8-\frac{8}{(x-1)^5}\Big)H(0;\alpha_0)+\Big(4d_1-\frac{4d_1}{(x-1)^5}\Big)H(1;\alpha_0)-\frac{16}{x-2}+\frac{15}{2(x-1)}+\frac{32}{3(x-2)^2}+\frac{1}{3(x-1)^2}-$$

$$\frac{32}{3(x-2)^3}+\frac{5}{(x-1)^3}+\frac{17}{2(x-1)^4}+\frac{25}{2(x-1)^5}-\frac{25}{2}\Big)H(2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\frac{\alpha_0^4}{x-1}-\alpha_0^4-\frac{4\alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+$$

$$\frac{6\alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\alpha_0}{(x-1)^4}+16\alpha_0+\frac{8H(0;\alpha_0)}{(x-1)^5}+\frac{4d_1\,H(1;\alpha_0)}{(x-1)^5}-\frac{3}{x-1}+$$

$$\frac{2}{3(x-1)^2}+\frac{2}{3(x-1)^3}-\frac{3}{(x-1)^4}-\frac{25}{3(x-1)^5}-\frac{25}{3}\Big)H(c_1(\alpha_0),0,c_1(\alpha_0);x)+\Big(-\frac{3\alpha_0^4}{x-1}+3\alpha_0^4+\frac{12\alpha_0^3}{x-1}-\frac{4\alpha_0^3}{(x-1)^2}-$$

$$16\alpha_0^3-\frac{18\alpha_0^2}{x-1}+\frac{12\alpha_0^2}{(x-1)^2}-\frac{6\alpha_0^2}{(x-1)^3}+36\alpha_0^2+\frac{12\alpha_0}{x-1}-\frac{12\alpha_0}{(x-1)^2}+\frac{12\alpha_0}{(x-1)^3}-\frac{12\alpha_0}{(x-1)^4}-48\alpha_0-\frac{16\,H(0;\alpha_0)}{(x-1)^5}-\frac{8d_1\,H(1;\alpha_0)}{(x-1)^5}+$$

$$\frac{9}{x-1}-\frac{2}{(x-1)^2}-\frac{2}{(x-1)^3}+\frac{9}{(x-1)^4}+\frac{25}{(x-1)^5}+25\Bigg)H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(-\frac{3\alpha_0^4}{2(x-1)}+\frac{3\alpha_0^4}{2}+\frac{6\alpha_0^3}{x-1}-$$
$$\frac{2\alpha_0^3}{(x-1)^2}-8\alpha_0^3-\frac{9\alpha_0^2}{x-1}+\frac{6\alpha_0^2}{(x-1)^2}-\frac{3\alpha_0^2}{(x-1)^3}+18\alpha_0^2+\frac{6\alpha_0}{x-1}-\frac{6\alpha_0}{(x-1)^2}+\frac{6\alpha_0}{(x-1)^3}-\frac{6\alpha_0}{(x-1)^4}-24\alpha_0-\frac{8H(0;\alpha_0)}{(x-1)^5}-$$
$$\frac{4d_1\ H(1;\alpha_0)}{(x-1)^5}+\frac{9}{2\ (x-1)}-\frac{1}{(x-1)^2}-\frac{1}{(x-1)^3}+\frac{9}{2\ (x-1)^4}+\frac{25}{2(x-1)^5}+\frac{25}{2}\Bigg)\ H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{\alpha_0^4}{x-1}-$$
$$\alpha_0^4-\frac{4\alpha_0^3}{x-1}+\frac{4\alpha_0^3}{3(x-1)^2}+\frac{16\alpha_0^3}{3}+\frac{6\alpha_0^2}{x-1}-\frac{4\alpha_0^2}{(x-1)^2}+\frac{2\alpha_0^2}{(x-1)^3}-12\alpha_0^2-\frac{4\alpha_0}{x-1}+\frac{4\alpha_0}{(x-1)^2}-\frac{4\alpha_0}{(x-1)^3}+\frac{4\alpha_0}{(x-1)^4}+16\alpha_0-$$
$$\frac{8}{x-2}+\frac{1}{x-1}+\frac{16}{3\ (x-2)^2}+\frac{4}{3(x-1)^2}-\frac{16}{3\ (x-2)^3}+\frac{2}{(x-1)^3}+\frac{4}{(x-1)^4}-\frac{25}{3}\Bigg)H(c_2(\alpha_0),0,c_1(\alpha_0);x)+\Bigg(-\frac{5\alpha_0^4}{2(x-1)}+$$
$$\frac{5\alpha_0^4}{2}+\frac{10\alpha_0^3}{x-1}-\frac{10\alpha_0^3}{3(x-1)^2}-\frac{40\alpha_0^3}{3}-\frac{15\alpha_0^2}{x-1}+\frac{10\alpha_0^2}{(x-1)^2}-\frac{5\alpha_0^2}{(x-1)^3}+30\alpha_0^2+\frac{10\alpha_0}{x-1}-\frac{10\alpha_0}{(x-1)^2}+\frac{10\alpha_0}{(x-1)^3}-\frac{10\alpha_0}{(x-1)^4}-40\alpha_0+$$
$$\frac{20}{x-2}-\frac{5}{2(x-1)}-\frac{40}{3(x-2)^2}-\frac{10}{3\ (x-1)^2}+\frac{40}{3\ (x-2)^3}-\frac{5}{(x-1)^3}-\frac{10}{(x-1)^4}+\frac{125}{6}\Bigg)\ H(c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$64\ H(0,0,0,0;x)+\Bigg(\frac{12}{(x-1)^5}-12\Bigg)\ H(0,0,0,c_1(\alpha_0);x)+\Bigg(\frac{4d_1}{(x-1)^5}-4\ d_1-\frac{12}{(x-1)^5}+12\Bigg)H(0,0,1,0;x)+$$
$$\Bigg(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{12}{(x-1)^5}-12\Bigg)\ H(0,0,1,c_1(\alpha_0);x)+\Bigg(-8-\frac{8}{(x-1)^5}\Bigg)\ H(0,0,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Bigg(\frac{4}{(x-1)^5}-4\Bigg)\ H(0,0,c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{8d_1}{(x-1)^5}-8\ d_1-\frac{8}{(x-1)^5}+8\Bigg)\ H(0,1,0,0;x)+\Bigg(\frac{16}{(x-1)^5}-$$
$$\frac{8d_1}{(x-1)^5}\Bigg)\ H(0,1,0,c_1(\alpha_0);x)+\Bigg(-\frac{4d_1^2}{(x-1)^5}+4d_1^2+\frac{12\ d_1}{(x-1)^5}-4d_1-\frac{16}{(x-1)^5}\Bigg)H(0,1,1,0;x)+\Bigg(\frac{4\ d_1^2}{(x-1)^5}-$$
$$4d_1^2-\frac{12d_1}{(x-1)^5}+4\ d_1+\frac{16}{(x-1)^5}\Bigg)H(0,1,1,c_1(\alpha_0);x)+\Bigg(8\ d_1-\frac{8}{(x-1)^5}-8\Bigg)H(0,1,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Bigg(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-4\Bigg)\ H(0,2,0,c_1(\alpha_0);x)+\Bigg(\frac{4d_1}{(x-1)^5}-4\ d_1-\frac{4}{(x-1)^5}+4\Bigg)H(0,2,1,0;x)+\Bigg(-$$
$$\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-4\Bigg)\ H(0,2,1,c_1(\alpha_0);x)+\Bigg(\frac{4d_1}{(x-1)^5}-4\ d_1-\frac{4}{(x-1)^5}+4\Bigg)\ H(0,2,c_2(\alpha_0),c_1(\alpha_0);x)+$$
$$\Bigg(4+\frac{4}{(x-1)^5}\Bigg)\ H(0,c_1(\alpha_0),0,c_1(\alpha_0);x)+\Bigg(-12-\frac{4}{(x-1)^5}\Bigg)\ H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(-6-$$
$$\frac{2}{(x-1)^5}\Bigg)\ H(0,c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(4-\frac{4}{(x-1)^5}\Bigg)\ H(0,c_2(\alpha_0),0,c_1(\alpha_0);x)+\Bigg(\frac{10}{(x-1)^5}-$$
$$10\Bigg)\ H(0,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(16-\frac{16}{(x-1)^5}\Bigg)\ H(1,0,0,0;x)+\Bigg(-\frac{4d_1}{(x-1)^5}+\frac{12}{(x-1)^5}-$$
$$4\Bigg)\ H(1,0,0,c_1(\alpha_0);x)+\Bigg(-\frac{4d_1^2}{(x-1)^5}+\frac{12\ d_1}{(x-1)^5}-\frac{12}{(x-1)^5}+4\Bigg)H(1,0,1,0;x)+\Bigg(\frac{4\ d_1^2}{(x-1)^5}-\frac{12d_1}{(x-1)^5}+$$
$$\frac{12}{(x-1)^5}-4\Bigg)\ H(1,0,1,c_1(\alpha_0);x)+\Bigg(\frac{4}{(x-1)^5}-4\Bigg)H(1,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(-\frac{4d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+$$
$$6\Bigg)\ H(1,0,c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{16d_1}{(x-1)^5}-8\ d_1-\frac{16}{(x-1)^5}\Bigg)H(1,1,0,0;x)+\Bigg(\frac{4\ d_1^2}{(x-1)^5}-\frac{16d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+$$
$$4\Bigg)\ H(1,1,0,c_1(\alpha_0);x)+\Bigg(-\frac{12d_1^2}{(x-1)^5}+4d_1^2+\frac{24\ d_1}{(x-1)^5}-\frac{12}{(x-1)^5}-4\Bigg)H(1,1,1,0;x)+\Bigg(\frac{12\ d_1^2}{(x-1)^5}-4d_1^2-$$
$$\frac{24\ d_1}{(x-1)^5}+\frac{12}{(x-1)^5}+4\Bigg)\ H(1,1,1,c_1(\alpha_0);x)+\Bigg(-\frac{4d_1^2}{(x-1)^5}+8\ d_1+\frac{4}{(x-1)^5}-4\Bigg)H(1,1,c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Bigg(-\frac{4\ d_1}{(x-1)^5}+\frac{2}{(x-1)^5}+6\Bigg)\ H(1,2,0,c_1(\alpha_0);x)+\Bigg(\frac{4\ d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Bigg)H(1,2,1,0;x)+\Bigg(-\frac{4\ d_1}{(x-1)^5}+$$
$$\frac{2}{(x-1)^5}+6\Bigg)\ H(1,2,1,c_1(\alpha_0);x)+\Bigg(\frac{4\ d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Bigg)\ H(1,2,c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(-\frac{4\ d_1}{(x-1)^5}+$$
$$\frac{4}{(x-1)^5}+4\Bigg)\ H(1,c_1(\alpha_0),0,c_1(\alpha_0);x)+\Bigg(\frac{8\ d_1}{(x-1)^5}-\frac{4}{(x-1)^5}-12\Bigg)\ H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)+$$
$$\Bigg(\frac{4\ d_1}{(x-1)^5}-\frac{2}{(x-1)^5}-6\Bigg)\ H(1,c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{4}{(x-1)^5}-4\Bigg)\ H(2,0,0,c_1(\alpha_0);x)+\Bigg(\frac{4d_1}{(x-1)^5}-$$
$$4\ d_1-\frac{4}{(x-1)^5}+4\Bigg)H(2,0,1,0;x)+\Bigg(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{4}{(x-1)^5}-4\Bigg)\ H(2,0,1,c_1(\alpha_0);x)+\Bigg(\frac{10}{(x-1)^5}-$$
$$10\Bigg)\ H(2,0,c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(8-\frac{8}{(x-1)^5}\Bigg)\ H(2,0,c_2(\alpha_0),c_1(\alpha_0);x)+\Bigg(8-\frac{8}{(x-1)^5}\Bigg)\ H(2,1,0,0;x)+$$
$$\Bigg(2-\frac{2}{(x-1)^5}\Bigg)\ H(2,1,0,c_1(\alpha_0);x)+\Bigg(\frac{4d_1}{(x-1)^5}-4\ d_1+\frac{2}{(x-1)^5}-2\Bigg)H(2,1,1,0;x)+\Bigg(-\frac{4\ d_1}{(x-1)^5}+$$
$$4d_1-\frac{2}{(x-1)^5}+2\Bigg)\ H(2,1,1,c_1(\alpha_0);x)+\Bigg(\frac{10}{(x-1)^5}-10\Bigg)\ H(2,1,c_1(\alpha_0),c_1(\alpha_0);x)+\Bigg(\frac{4d_1}{(x-1)^5}-4\ d_1-$$
$$\frac{8}{(x-1)^5}+8\Bigg)H(2,2,0,c_1(\alpha_0);x)+\Bigg(-\frac{4\ d_1}{(x-1)^5}+4d_1+\frac{8}{(x-1)^5}-8\Bigg)\ H(2,2,1,0;x)+\Bigg(\frac{4d_1}{(x-1)^5}-4\ d_1-$$

$$
\begin{aligned}
&\tfrac{8}{(x-1)^5}+8\Big)H(2,2,1,c_1(\alpha_0);x)+\Big(-\tfrac{4\,d_1}{(x-1)^5}+4d_1+\tfrac{8}{(x-1)^5}-8\Big)\,H(2,2,c_2(\alpha_0),c_1(\alpha_0);x)+\Big(\tfrac{4}{(x-1)^5}-\\
&4\Big)\,H(2,c_2(\alpha_0),0,c_1(\alpha_0);x)+\Big(10-\tfrac{10}{(x-1)^5}\Big)\,H(2,c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)-\tfrac{4\,H(c_1(\alpha_0),0,0,c_1(\alpha_0);x)}{(x-1)^5}+\\
&\tfrac{8\,H(c_1(\alpha_0),0,c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\tfrac{4H(c_1(\alpha_0),0,c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\tfrac{4\,H(c_1(\alpha_0),c_1(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\\
&\tfrac{12\,H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}-\tfrac{6\,H(c_1(\alpha_0),c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+\tfrac{4\,H(c_1(\alpha_0),c_2(\alpha_0),0,c_1(\alpha_0);x)}{(x-1)^5}-\\
&\tfrac{10\,H(c_1(\alpha_0),c_2(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);x)}{(x-1)^5}+H(2;x)\,\Big(\tfrac{2\pi^2d_1}{x-2}-\tfrac{4\pi^2d_1}{3(x-2)^2}-\tfrac{2\,\pi^2d_1}{3(x-1)^2}+\tfrac{4\pi^2d_1}{3(x-2)^3}-\tfrac{2\pi^2\,d_1}{(x-1)^4}-\tfrac{4\pi^2}{x-2}+\tfrac{15\pi^2}{8(x-1)}+\\
&\tfrac{8\,\pi^2}{3(x-2)^2}+\tfrac{\pi^2}{12(x-1)^2}-\tfrac{8\pi^2}{3\,(x-2)^3}+\tfrac{5\pi^2}{4(x-1)^3}+\tfrac{17\pi^2}{8\,(x-1)^4}+\tfrac{25\pi^2}{8(x-1)^5}-\tfrac{7\zeta_3}{2\,(x-1)^5}+\tfrac{7\zeta_3}{2}+\tfrac{3\pi^2\ln 2}{(x-1)^5}-3\pi^2\ln 2-\\
&\tfrac{25\pi^2}{8}\Big)+H(0;x)\Big(-\tfrac{63d_1^2}{16\,(x-1)}+\tfrac{19d_1^2}{54(x-1)^2}+\tfrac{19d_1^2}{54\,(x-1)^3}-\tfrac{63d_1^2}{16(x-1)^4}-\tfrac{2035d_1^2}{432\,(x-1)^5}-\tfrac{2035d_1^2}{432}-\tfrac{38d_1}{3(x-2)}+\tfrac{161\,d_1}{12(x-1)}+\\
&\tfrac{76d_1}{9(x-2)^2}-\tfrac{323d_1}{108\,(x-1)^2}-\tfrac{605d_1}{108(x-1)^3}+\tfrac{50d_1}{3\,(x-1)^4}+\tfrac{895d_1}{27(x-1)^5}+\tfrac{2035d_1}{108}+\tfrac{4\pi^2}{x-2}+\tfrac{68}{3(x-2)}-\tfrac{3\pi^2}{8(x-1)}-\tfrac{3}{2\,(x-1)}-\\
&\tfrac{8\pi^2}{3(x-2)^2}-\tfrac{152}{9(x-2)^2}-\tfrac{25\pi^2}{36(x-1)^2}+\tfrac{215}{108(x-1)^2}+\tfrac{8\pi^2}{3\,(x-2)^3}-\tfrac{37\pi^2}{36(x-1)^3}+\tfrac{1643}{108\,(x-1)^3}-\tfrac{15\pi^2}{8(x-1)^4}-\tfrac{8}{(x-1)^4}+\tfrac{25\pi^2}{72(x-1)^5}-\\
&\tfrac{5665}{108(x-1)^5}+\tfrac{21\,\zeta_3}{(x-1)^5}+33\zeta_3-\tfrac{2\pi^2\ln 2}{(x-1)^5}+2\pi^2\ln 2+\tfrac{325\pi^2}{72}-\tfrac{1855}{108}\Big)+H(1;x)\Big(-\tfrac{21\zeta_3d_1}{2(x-1)^5}+\tfrac{\pi^2\ln 2\,d_1}{(x-1)^5}+\Big(-\\
&\tfrac{4d_1^2}{x-1}+\tfrac{d_1^2}{(x-1)^2}-\tfrac{4d_1^2}{9\,(x-1)^3}+\tfrac{d_1^2}{4(x-1)^4}-\tfrac{205d_1^2}{36\,(x-1)^5}-\tfrac{46d_1}{3(x-2)}+\tfrac{46d_1}{3(x-1)}+\tfrac{52\,d_1}{9(x-2)^2}-\tfrac{40d_1}{9(x-1)^2}-\tfrac{28d_1}{9\,(x-2)^3}+\tfrac{98d_1}{9(x-1)^3}-\\
&\tfrac{13d_1}{6(x-1)^4}+\tfrac{415\,d_1}{18(x-1)^5}+\tfrac{80}{3(x-2)}+\tfrac{43}{6(x-1)}-\tfrac{56}{9\,(x-2)^2}-\tfrac{299}{18(x-1)^2}+\tfrac{56}{9(x-2)^3}-\tfrac{23}{6\,(x-1)^3}-\tfrac{203}{6(x-1)^4}-\tfrac{\pi^2}{6(x-1)^5}-\\
&\tfrac{35}{6\,(x-1)^5}+\tfrac{\pi^2}{6}+\tfrac{35}{6}\Big)H(0;\alpha_0)+\Big(-\tfrac{8\,d_1}{x-1}+\tfrac{4d_1}{(x-1)^2}-\tfrac{8d_1}{3(x-1)^3}+\tfrac{2\,d_1}{(x-1)^4}-\tfrac{50d_1}{3(x-1)^5}-\tfrac{16}{x-2}+\tfrac{32}{3\,(x-2)^2}+\tfrac{16}{3(x-1)^2}-\\
&\tfrac{32}{3(x-2)^3}+\tfrac{16}{(x-1)^4}\Big)H(0,0;\alpha_0)+\Big(-\tfrac{4d_1^2}{x-1}+\tfrac{2\,d_1^2}{(x-1)^2}-\tfrac{4d_1^2}{3\,(x-1)^3}+\tfrac{d_1^2}{(x-1)^4}-\tfrac{25d_1^2}{3(x-1)^5}-\tfrac{8\,d_1}{x-2}+\tfrac{16d_1}{3(x-2)^2}+\tfrac{8d_1}{3(x-1)^2}-\\
&\tfrac{16\,d_1}{3(x-2)^3}+\tfrac{8d_1}{(x-1)^4}\Big)\,H(0,1;\alpha_0)+\Big(\tfrac{16}{(x-1)^5}-16\Big)H(0,0,0;\alpha_0)+\Big(\tfrac{8\,d_1}{(x-1)^5}-8d_1\Big)H(0,0,1;\alpha_0)+\Big(\tfrac{8d_1}{(x-1)^5}-\\
&8\,d_1\Big)H(0,1,0;\alpha_0)+\Big(\tfrac{4d_1^2}{(x-1)^5}-4d_1^2\Big)\,H(0,1,1;\alpha_0)-\tfrac{2\pi^2}{3(x-2)}+\tfrac{7\pi^2}{12\,(x-1)}+\tfrac{4\pi^2}{9(x-2)^2}-\tfrac{4\pi^2}{9\,(x-2)^3}+\tfrac{\pi^2}{18(x-1)^3}+\\
&\tfrac{5\pi^2}{6\,(x-1)^4}+\tfrac{25\pi^2}{18(x-1)^5}+\tfrac{21\zeta_3}{4\,(x-1)^5}+\tfrac{63\zeta_3}{4}-\tfrac{\pi^2\ln 2}{2\,(x-1)^5}-\tfrac{3}{2}\pi^2\ln 2+\tfrac{25\pi^2}{36}\Big)+\tfrac{8d_1\pi^2}{3(x-2)}-\tfrac{37\pi^2}{6\,(x-2)}-\tfrac{35d_1\pi^2}{48(x-1)}+\\
&\tfrac{31\pi^2}{48\,(x-1)}-\tfrac{7d_1\pi^2}{9(x-2)^2}+\tfrac{10\pi^2}{9\,(x-2)^2}-\tfrac{7d_1\pi^2}{9(x-1)^2}+\tfrac{107\pi^2}{48\,(x-1)^2}+\tfrac{7d_1\pi^2}{9(x-2)^3}-\tfrac{14\pi^2}{9\,(x-2)^3}-\tfrac{5d_1\pi^2}{4(x-1)^3}+\tfrac{55\pi^2}{16(x-1)^3}-\tfrac{d_1\pi^2}{(x-1)^4}+\\
&\tfrac{115\pi^2}{24(x-1)^4}-\tfrac{263\,\pi^4}{720(x-1)^5}+\tfrac{35\pi^2}{36(x-1)^5}+\tfrac{7\,\zeta_3}{x-2}-\tfrac{203\zeta_3}{16(x-1)}-\tfrac{14\zeta_3}{3\,(x-2)^2}+\tfrac{35\zeta_3}{24(x-1)^2}+\tfrac{14\zeta_3}{3\,(x-2)^3}+\tfrac{7\zeta_3}{8(x-1)^3}-\tfrac{245\zeta_3}{16\,(x-1)^4}-\\
&\tfrac{525\zeta_3}{16(x-1)^5}-\tfrac{1225\,\zeta_3}{48}+\tfrac{4\mathrm{Li}_4\left(\frac{1}{2}\right)}{(x-1)^5}-4\mathrm{Li}_4\tfrac{1}{2}+\tfrac{\ln^4 2}{6(x-1)^5}-\tfrac{\ln^4 2}{6}+\tfrac{4\pi^2\ln^2 2}{3(x-1)^5}-\tfrac{4}{3}\pi^2\,\ln^2 2-\tfrac{6\pi^2\ln 2}{x-2}+\tfrac{15\pi^2\ln 2}{8\,(x-1)}+\\
&\tfrac{4\pi^2\ln 2}{(x-2)^2}+\tfrac{3\pi^2\ln 2}{4\,(x-1)^2}-\tfrac{4\pi^2\ln 2}{(x-2)^3}+\tfrac{5\pi^2\ln 2}{4\,(x-1)^3}+\tfrac{33\pi^2\ln 2}{8(x-1)^4}+\tfrac{25\pi^2\ln 2}{8(x-1)^5}-\tfrac{25}{8}\pi^2\ln 2-\tfrac{21\pi^4}{80}+\tfrac{205d_1\pi^2}{144}-\tfrac{265\pi^2}{48}.
\end{aligned}
$$

F. The $\mathcal{J}{*}\mathcal{I}$-type integrals

F.1 The $\mathcal{J}{*}\mathcal{I}$ integral for $k=0$

The ε expansion for this integral reads

$$
\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;0)=\frac{1}{\varepsilon^3}(j*i)^{(0)}_{-3}+\frac{1}{\varepsilon^2}(j*i)^{(0)}_{-2}+\frac{1}{\varepsilon}(j*i)^{(0)}_{-1}+(j*i)^{(0)}_{0}+\mathcal{O}\left(\varepsilon\right), \qquad \text{(F.1)}
$$

where

$$
(j*i)^{(0)}_{-3}=\tfrac{1}{2},
$$

$$
(j*i)^{(0)}_{-2}=\tfrac{2y_0^3}{3}-3y_0^2+6y_0-\tfrac{1}{2}H(0;Y)-2H(0;y_0)+1,
$$

$$
\begin{aligned}
&(j*i)^{(0)}_{-1}=-\tfrac{1}{6}y_0^3\alpha_0^4+\tfrac{y_0^2\alpha_0^4}{2}-\tfrac{y_0\,\alpha_0^4}{2}+\tfrac{8y_0^3\alpha_0^3}{9}-3y_0^2\alpha_0^3+\tfrac{10y_0\,\alpha_0^3}{3}-2y_0^3\alpha_0^2+\tfrac{15y_0^2\alpha_0^2}{2}-10y_0\alpha_0^2+\\
&\tfrac{8\,y_0^3\alpha_0}{3}-11y_0^2\alpha_0+18y_0\alpha_0-\tfrac{2d_1'y_0^3}{9}+2y_0^3+\tfrac{7d_1'y_0^2}{6}-\tfrac{21y_0^2}{2}-\tfrac{11d_1'y_0}{3}+30\,y_0+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6y_0+
\end{aligned}
$$

$$\frac{2}{y_0-1}+2\Big)H(0;\alpha_0)-\frac{2}{3}y_0^3H(0;Y)+3y_0^2H(0;Y)-6y_0H(0;Y)-H(0;Y)+\Big(-2y_0^3+9y_0^2-$$
$$18y_0+2H(0;Y)-\frac{2}{y_0-1}-6\Big)H(0;y_0)+\Big(-\frac{2d_1'y_0^3}{3}+3d_1'y_0^2-6d_1'y_0+\frac{11d_1'}{3}-2H(0;\alpha_0)\Big)H(1;y_0)+$$
$$\Big(-2\alpha_0+\frac{2}{y_0-1}+2\Big)H(c_1(\alpha_0);y_0)+\frac12H(0,0;Y)+8H(0,0;y_0)+2d_1'H(0,1;y_0)-$$
$$2H(0,c_1(\alpha_0);y_0)+\frac12H(1,0;Y)+2H(1,0;y_0)-2H(1,c_1(\alpha_0);y_0)+\frac{\pi^2}{12}+2,$$

$$(j*i)_0^{(0)}=\frac{1}{12}d_1y_0^3\alpha_0^4+\frac{1}{18}d_1'y_0^3\alpha_0^4-\frac{7y_0^3\alpha_0^4}{12}-\frac14d_1y_0^2\alpha_0^4-\frac16d_1'y_0^2\alpha_0^4+\frac{23y_0^2\alpha_0^4}{12}+\frac14d_1y_0\alpha_0^4+\frac16d_1'y_0\alpha_0^4-$$
$$\frac{29y_0\alpha_0^4}{12}+\frac16y_0^3H(0;Y)\alpha_0^4-\frac12y_0^2H(0;Y)\alpha_0^4+\frac12y_0H(0;Y)\alpha_0^4-\frac{13}{27}d_1y_0^3\alpha_0^3-\frac{8}{27}d_1'y_0^3\alpha_0^3+\frac{173y_0^3\alpha_0^3}{54}+$$
$$\frac53d_1y_0^2\alpha_0^3+\frac{19}{18}d_1'y_0^2\alpha_0^3-\frac{217y_0^2\alpha_0^3}{18}-\frac{17}{9}d_1y_0\alpha_0^3-\frac{11}{9}d_1'y_0\alpha_0^3+\frac{305y_0\alpha_0^3}{18}-\frac89y_0^3H(0;Y)\alpha_0^3+3y_0^2H(0;Y)\alpha_0^3-$$
$$\frac{10}{3}y_0H(0;Y)\alpha_0^3+\frac{23}{18}d_1y_0^3\alpha_0^2+\frac23d_1'y_0^3\alpha_0^2-\frac{275y_0^3\alpha_0^2}{36}-5d_1y_0^2\alpha_0^2-\frac{11}{4}d_1'y_0^2\alpha_0^2+\frac{581y_0^2\alpha_0^2}{18}+\frac{43}{6}d_1y_0\alpha_0^2+$$
$$\frac92d_1'y_0\alpha_0^2-\frac{1003y_0\alpha_0^2}{18}+2y_0^3H(0;Y)\alpha_0^2-\frac{15}{2}y_0^2H(0;Y)\alpha_0^2+10y_0H(0;Y)\alpha_0^2-\frac{25}{9}d_1y_0^3\alpha_0-\frac89d_1'y_0^3\alpha_0+$$
$$\frac{217y_0^3\alpha_0}{18}+12d_1y_0^2\alpha_0+\frac{25}{6}d_1'y_0^2\alpha_0-\frac{503y_0^2\alpha_0}{9}-\frac{65d_1y_0\alpha_0}{3}-\frac{29d_1'y_0\alpha_0}{3}+\frac{237y_0\alpha_0}{2}-\frac83y_0^3H(0;Y)\alpha_0+$$
$$11y_0^2H(0;Y)\alpha_0-18y_0H(0;Y)\alpha_0+\frac{2d_1'^2y_0^3}{27}-\frac{8d_1'y_0^3}{9}+\frac{14y_0^3}{3}-\frac{17d_1'^2y_0^2}{36}+6d_1'y_0^2-\frac{111y_0^2}{4}+\frac{49d_1'^2y_0}{18}-$$
$$\frac{65d_1'y_0}{2}+114y_0+\frac29d_1'y_0^3H(0;Y)-2y_0^3H(0;Y)-\frac76d_1'y_0^2H(0;Y)+\frac{21}{2}y_0^2H(0;Y)+\frac{11}{3}d_1'y_0H(0;Y)-$$
$$30y_0H(0;Y)-\frac{1}{12}\pi^2H(0;Y)-2H(0;Y)+H(0;\alpha_0)\Big(\frac{y_0^3\alpha_0^4}{3}-y_0^2\alpha_0^4+y_0\alpha_0^4-\frac{16y_0^3\alpha_0^3}{9}+6y_0^2\alpha_0^3-\frac{20y_0\alpha_0^3}{3}+$$
$$4y_0^3\alpha_0^2-15y_0^2\alpha_0^2+20y_0\alpha_0^2-\frac{16y_0^3\alpha_0}{3}+22y_0^2\alpha_0-36y_0\alpha_0+\frac{2d_1'y_0^3}{9}-\frac{11y_0^3}{18}-\frac{7d_1'y_0^2}{6}+\frac{31y_0^2}{6}-4d_1+2d_1'+\frac{11d_1'y_0}{3}-$$
$$\frac{131y_0}{6}+\frac23y_0^3H(0;Y)-3y_0^2H(0;Y)+6y_0H(0;Y)-\frac{2H(0;Y)}{y_0-1}-2H(0;Y)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{61}{6(y_0-1)}+\frac{61}{6}\Big)+$$
$$\Big(\frac13d_1y_0^3\alpha_0^4-d_1y_0^2\alpha_0^4+d_1y_0\alpha_0^4-\frac{16}{9}d_1y_0^3\alpha_0^3+6d_1y_0^2\alpha_0^3-\frac{20}{3}d_1y_0\alpha_0^3+4d_1y_0^3\alpha_0^2-15d_1y_0^2\alpha_0^2+20d_1y_0\alpha_0^2-$$
$$\frac{16}{3}d_1y_0^3\alpha_0+22d_1y_0^2\alpha_0-36d_1y_0\alpha_0+\frac{25d_1y_0^3}{9}-12d_1y_0^2+\frac{65d_1y_0}{3}\Big)H(1;\alpha_0)-\frac{1}{12}\pi^2H(1;Y)+\Big(\frac{y_0^3\alpha_0^4}{6}-\frac{y_0^2\alpha_0^4}{2}+$$
$$\frac{y_0\alpha_0^4}{2}-\frac{\alpha_0^4}{6}-\frac{8y_0^3\alpha_0^3}{9}+3y_0^2\alpha_0^3-\frac{10y_0\alpha_0^3}{3}+\frac{11\alpha_0^3}{9}+2y_0^3\alpha_0^2-\frac{15y_0^2\alpha_0^2}{2}+10y_0\alpha_0^2-\frac{9\alpha_0^2}{2}-\frac{8y_0^3\alpha_0}{3}+11y_0^2\alpha_0+4d_1\alpha_0-$$
$$2d_1'\alpha_0-18y_0\alpha_0+2H(0;Y)\alpha_0-2\alpha_0+\frac{25y_0^3}{18}-\frac{16y_0^2}{3}-4d_1+2d_1'+\frac{49y_0}{6}+\Big(4\alpha_0-\frac{4}{y_0-1}-4\Big)H(0;\alpha_0)-$$
$$\frac{2H(0;Y)}{y_0-1}-2H(0;Y)+\Big(4\alpha_0d_1-\frac{4d_1}{y_0-1}-4d_1\Big)H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{61}{6(y_0-1)}+\frac{61}{6}\Big)H(c_1(\alpha_0);y_0)+$$
$$\Big(\frac{4y_0^3}{3}-6y_0^2+12y_0-\frac{4}{y_0-1}-4\Big)H(0,0;\alpha_0)+\frac23y_0^3H(0,0;Y)-3y_0^2H(0,0;Y)+6y_0H(0,0;Y)+$$
$$H(0,0;Y)+\Big(\frac{20y_0^3}{3}-30y_0^2+60y_0-8H(0;Y)+\frac{12}{y_0-1}+28\Big)H(0,0;y_0)+\Big(\frac{4d_1y_0^3}{3}-6d_1y_0^2+12d_1y_0-4d_1-$$
$$\frac{4d_1}{y_0-1}\Big)H(0,1;\alpha_0)+H(1;y_0)\Big(\frac16d_1'y_0^3\alpha_0^4-\frac12d_1'y_0^2\alpha_0^4-\frac{d_1'\alpha_0^4}{6}+\frac12d_1'y_0\alpha_0^4-\frac89d_1'y_0^3\alpha_0^3+3d_1'y_0^2\alpha_0^3+\frac{11d_1'\alpha_0^3}{9}-$$
$$\frac{10}{3}d_1'y_0\alpha_0^3+2d_1'y_0^3\alpha_0^2-\frac{15}{2}d_1'y_0^2\alpha_0^2-\frac{9d_1'\alpha_0^2}{2}+10d_1'y_0\alpha_0^2-\frac83d_1'y_0^3\alpha_0+11d_1'y_0^2\alpha_0+\frac{23d_1'\alpha_0}{3}-18d_1'y_0\alpha_0+$$
$$\frac{2d_1'^2y_0^3}{9}-2d_1'y_0^3-\frac{49d_1'^2}{18}-\frac{7d_1'^2y_0^2}{6}+\frac{21d_1'y_0^2}{2}+\frac{43d_1'}{2}+\frac{11d_1'^2y_0}{3}-30d_1'y_0+\frac23d_1'y_0^3H(0;Y)-3d_1'y_0^2H(0;Y)-$$
$$\frac{11}{3}d_1'H(0;Y)+6d_1'y_0H(0;Y)+H(0;\alpha_0)\Big(\frac{2d_1'y_0^3}{3}-\frac{2y_0^3}{3}-3d_1'y_0^2+3y_0^2+6d_1'y_0-6y_0-\frac{11d_1'}{3}+2H(0;Y)+$$
$$\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{2}{y_0-1}-10\Big)+4H(0,0;\alpha_0)+4d_1H(0,1;\alpha_0)-\frac{\pi^2}{3}\Big)+\Big(2d_1'y_0^3-9d_1'y_0^2+18d_1'y_0+6d_1'+$$
$$(4-4d_1)H(0;\alpha_0)-2d_1'H(0;Y)+\frac{2d_1'}{y_0-1}\Big)H(0,1;y_0)+\Big(-\frac{2y_0^3}{3}+3y_0^2-6y_0+4H(0;\alpha_0)+2H(0;Y)+$$
$$4d_1H(1;\alpha_0)-\frac{6}{y_0-1}-10\Big)H(0,c_1(\alpha_0);y_0)+H(0;y_0)\Big(\frac{y_0^3\alpha_0^4}{3}-y_0^2\alpha_0^4+y_0\alpha_0^4-\frac{16y_0^3\alpha_0^3}{9}+6y_0^2\alpha_0^3-\frac{20y_0\alpha_0^3}{3}+$$
$$4y_0^3\alpha_0^2-15y_0^2\alpha_0^2+20y_0\alpha_0^2-\frac{16y_0^3\alpha_0}{3}+22y_0^2\alpha_0-36y_0\alpha_0+\frac{2d_1'y_0^3}{3}-\frac{133y_0^3}{18}-\frac{7d_1'y_0^2}{2}+\frac{221y_0^2}{6}+4d_1-2d_1'+$$
$$11d_1'y_0-\frac{589y_0}{6}+\Big(\frac{4y_0^3}{3}-6y_0^2+12y_0-\frac{4}{y_0-1}-4\Big)H(0;\alpha_0)+2y_0^3H(0;Y)-9y_0^2H(0;Y)+18y_0H(0;Y)+$$
$$\frac{2H(0;Y)}{y_0-1}+6H(0;Y)-2H(0,0;Y)-2H(1,0;Y)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{61}{6(y_0-1)}-\frac{\pi^2}{3}-\frac{109}{6}\Big)+\frac23y_0^3H(1,0;Y)-$$
$$3y_0^2H(1,0;Y)+6y_0H(1,0;Y)+H(1,0;Y)+\Big(2d_1'y_0^3+\frac{2y_0^3}{3}-9d_1'y_0^2-3y_0^2+18d_1'y_0+6y_0-11d_1'+$$

$$
\begin{aligned}
&4H(0;\alpha_0)-2H(0;Y)-\tfrac{4d_1}{y_0-1}+\tfrac{2\ d_1'}{y_0-1}+\tfrac{2}{y_0-1}+10\Big)H(1,0;y_0)+\Big(\tfrac{2d_1'^2\ y_0^3}{3}-3d_1'^2y_0^2+6d_1'^2y_0-\tfrac{11d_1'^2}{3}+\\
&(-4d_1+2\ d_1'+2)H(0;\alpha_0)\Big)H(1,1;y_0)+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6\ y_0+4H(0;\alpha_0)+2H(0;Y)+4d_1H(1;\alpha_0)+\\
&\tfrac{4d_1}{y_0-1}-\tfrac{2\ d_1'}{y_0-1}-\tfrac{2}{y_0-1}-10\Big)H(1,c_1(\alpha_0);y_0)+\Big(4\ \alpha_0-\tfrac{4}{y_0-1}-4\Big)H(c_1(\alpha_0),0;y_0)+\Big(2\alpha_0d_1'-\tfrac{2\ d_1'}{y_0-1}-\\
&2d_1'\Big)H(c_1(\alpha_0),1;y_0)+\Big(2\ \alpha_0-\tfrac{2}{y_0-1}-2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{1}{2}\ H(0,0,0;Y)-32H(0,0,0;y_0)-\\
&8d_1'H(0,0,1;y_0)+8H(0,0,c_1(\alpha_0);y_0)-\ \tfrac{1}{2}H(0,1,0;Y)+(4d_1-8d_1'-4)H(0,1,0;y_0)-\\
&2d_1'^2\ H(0,1,1;y_0)+(-4d_1+2d_1'+4)H(0,1,c_1(\alpha_0);y_0)+4\ H(0,c_1(\alpha_0),0;y_0)+2d_1'H(0,c_1(\alpha_0),1;y_0)+\\
&2\ H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{1}{2}H(1,0,0;Y)-12H(1,0,0;y_0)-2\ d_1'H(1,0,1;y_0)+6H(1,0,c_1(\alpha_0);y_0)-\\
&\tfrac{1}{2}H(1,1,0;Y)+(4\ d_1-2d_1'-2)H(1,1,0;y_0)+(-4d_1+2d_1'+2)H(1,1,c_1(\alpha_0);y_0)+\\
&4\ H(1,c_1(\alpha_0),0;y_0)+2d_1'H(1,c_1(\alpha_0),1;y_0)+2\ H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\tfrac{\pi^2}{3(y_0-1)}-3\ \zeta_3+\tfrac{\pi^2}{2}+4.
\end{aligned}
$$

F.2 The $\mathcal{J}{*}\mathcal{I}$ integral for $k = 1$

The ε expansion for this integral reads

$$
\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^3}(j*i)^{(1)}_{-3}+\frac{1}{\varepsilon^2}(j*i)^{(1)}_{-2}+\frac{1}{\varepsilon}(j*i)^{(1)}_{-1}+(j*i)^{(1)}_{0}+\mathcal{O}\left(\varepsilon\right), \qquad \text{(F.2)}
$$

where

$$
(j*i)^{(1)}_{-3}=\tfrac{1}{4},
$$

$$
(j*i)^{(1)}_{-2}=\tfrac{y_0^3}{3}-\tfrac{3y_0^2}{2}+3y_0-\tfrac{1}{4}\ H(0;Y)-H(0;y_0)+\tfrac{1}{2},
$$

$$
\begin{aligned}
&(j*i)^{(1)}_{-1}=\\
&-\tfrac{1}{12}y_0^3\alpha_0^4+\tfrac{y_0^2\alpha_0^4}{4}-\tfrac{y_0\ \alpha_0^4}{4}+\tfrac{4y_0^3\alpha_0^3}{9}-\tfrac{3y_0^2\alpha_0^3}{2}+\tfrac{5y_0\ \alpha_0^3}{3}-y_0^3\alpha_0^2+\tfrac{15y_0^2\alpha_0^2}{4}-5y_0\alpha_0^2+\tfrac{4\ y_0^3\alpha_0}{3}-\tfrac{11y_0^2\alpha_0}{2}+9y_0\alpha_0-\\
&\tfrac{d_1'\ y_0^3}{9}+y_0^3+\tfrac{7d_1'y_0^2}{12}-\tfrac{21y_0^2}{4}-\tfrac{11\ d_1'y_0}{6}+15y_0+\Big(-\tfrac{y_0^3}{3}+\tfrac{3y_0^2}{2}-3\ y_0+\tfrac{1}{y_0-1}+1\Big)H(0;\alpha_0)-\tfrac{1}{3}y_0^3\ H(0;Y)+\\
&\tfrac{3}{2}y_0^2H(0;Y)-3y_0H(0;Y)-\tfrac{1}{2}\ H(0;Y)+\Big(-y_0^3+\tfrac{9y_0^2}{2}-9\ y_0+H(0;Y)-\tfrac{1}{y_0-1}-3\Big)H(0;y_0)+\Big(-\\
&\tfrac{d_1'\ y_0^3}{3}+\tfrac{3d_1'y_0^2}{2}-3d_1'y_0+\tfrac{11\ d_1'}{6}-H(0;\alpha_0)\Big)H(1;y_0)+\Big(-\alpha_0+\tfrac{1}{y_0-1}+1\Big)\ H(c_1(\alpha_0);y_0)+\tfrac{1}{4}H(0,0;Y)+\\
&4H(0,0;y_0)+d_1'\ H(0,1;y_0)-H(0,c_1(\alpha_0);y_0)+\tfrac{1}{4}H(1,0;Y)+H(1,0;y_0)-H(1,c_1(\ \alpha_0);y_0)+\tfrac{\pi^2}{24}+1,
\end{aligned}
$$

$$
\begin{aligned}
&(j*i)^{(1)}_{0}=\tfrac{1}{24}d_1y_0^3\alpha_0^4+\tfrac{1}{36}d_1'y_0^3\alpha_0^4-\tfrac{7\ y_0^3\alpha_0^4}{24}-\tfrac{1}{8}d_1y_0^2\alpha_0^4-\tfrac{1}{12}d_1'y_0^2\ \alpha_0^4+\tfrac{23y_0^2\alpha_0^4}{24}+\tfrac{1}{8}d_1y_0\ \alpha_0^4+\\
&\tfrac{1}{12}d_1'y_0\alpha_0^4-\tfrac{29y_0\ \alpha_0^4}{24}+\tfrac{1}{12}y_0^3H(0;Y)\alpha_0^4-\tfrac{1}{4}y_0^2H(0;Y)\ \alpha_0^4+\tfrac{1}{4}y_0H(0;Y)\alpha_0^4-\tfrac{13}{54}d_1y_0^3\ \alpha_0^3-\tfrac{4}{27}d_1'y_0^3\alpha_0^3+\\
&\tfrac{173y_0^3\ \alpha_0^3}{108}+\tfrac{5}{6}d_1y_0^2\alpha_0^3+\tfrac{19}{36}d_1'y_0^2\ \alpha_0^3-\tfrac{217y_0^2\alpha_0^3}{36}-\tfrac{17}{18}d_1y_0\ \alpha_0^3-\tfrac{11}{18}d_1'y_0\alpha_0^3+\tfrac{305y_0\ \alpha_0^3}{36}-\tfrac{4}{9}y_0^3H(0;Y)\alpha_0^3+\\
&\tfrac{3}{2}y_0^2H(0;Y)\ \alpha_0^3-\tfrac{5}{3}y_0H(0;Y)\alpha_0^3+\tfrac{23}{36}d_1y_0^3\ \alpha_0^2+\tfrac{1}{3}d_1'y_0^3\alpha_0^2-\tfrac{275y_0^3\ \alpha_0^2}{72}-\tfrac{5}{2}d_1y_0^2\alpha_0^2-\tfrac{11}{8}d_1'y_0^2\alpha_0^2+\tfrac{581y_0^2\alpha_0^2}{36}+\\
&\tfrac{43}{12}d_1y_0\alpha_0^2+\tfrac{9}{4}\ d_1'y_0\alpha_0^2-\tfrac{1003y_0\alpha_0^2}{36}+y_0^3H(0;Y)\ \alpha_0^2-\tfrac{15}{4}y_0^2H(0;Y)\alpha_0^2+5y_0H(0;Y)\ \alpha_0^2-\tfrac{25}{18}d_1y_0^3\alpha_0-\\
&\tfrac{4}{9}d_1'y_0^3\ \alpha_0+\tfrac{217y_0^3\alpha_0}{36}+6d_1y_0^2\alpha_0+\tfrac{25}{12}d_1'y_0^2\ \alpha_0-\tfrac{503y_0^2\alpha_0}{18}-\tfrac{65d_1y_0\alpha_0}{6}-\tfrac{29d_1'\ y_0\alpha_0}{6}+\tfrac{237y_0\alpha_0}{4}-\tfrac{4}{3}y_0^3H(0;Y)\ \alpha_0+\\
&\tfrac{11}{2}y_0^2H(0;Y)\alpha_0-9y_0H(0;Y)\alpha_0+\tfrac{d_1'^2\ y_0^3}{27}-\tfrac{4d_1'y_0^3}{9}+\tfrac{7y_0^3}{3}-\tfrac{17d_1'^2\ y_0^2}{72}+3d_1'y_0^2-\tfrac{111y_0^2}{8}+\tfrac{49d_1'^2y_0}{36}-\\
&\tfrac{65d_1'y_0}{4}+57y_0+\tfrac{1}{9}d_1'y_0^3H(0;Y)-y_0^3\ H(0;Y)-\tfrac{7}{12}d_1'y_0^2H(0;Y)+\tfrac{21}{4}y_0^2\ H(0;Y)+\tfrac{11}{6}d_1'y_0H(0;Y)-\\
&15y_0H(0;Y)-\tfrac{1}{24}\pi^2\ H(0;Y)-H(0;Y)+H(0;\alpha_0)\Big(\tfrac{y_0^3\alpha_0^4}{6}-\tfrac{y_0^2\ \alpha_0^4}{2}+\tfrac{y_0\alpha_0^4}{2}-\tfrac{8y_0^3\alpha_0^3}{9}+3y_0^2\ \alpha_0^3-\tfrac{10y_0\alpha_0^3}{3}+\\
&2y_0^3\alpha_0^2-\tfrac{15y_0^2\ \alpha_0^2}{2}+10y_0\alpha_0^2-\tfrac{8y_0^3\alpha_0}{3}+11y_0^2\alpha_0-18y_0\alpha_0+\tfrac{d_1'y_0^3}{9}-\tfrac{11y_0^3}{36}-\tfrac{7d_1'\ y_0^2}{12}+\tfrac{31y_0^2}{12}-2d_1+d_1'+\tfrac{11d_1'\ y_0}{6}-\\
&\tfrac{131y_0}{12}+\tfrac{1}{3}y_0^3H(0;Y)-\tfrac{3}{2}y_0^2\ H(0;Y)+3y_0H(0;Y)-\tfrac{H(0;Y)}{y_0-1}-H(0;Y)-\tfrac{2\ d_1}{y_0-1}+\tfrac{d_1'}{y_0-1}+\tfrac{61}{12\ (y_0-1)}+\tfrac{61}{12}\Big)+
\end{aligned}
$$

$$
\begin{aligned}
&\Big(\tfrac{1}{6}d_1 y_0^3 \alpha_0^4 - \tfrac{1}{2}d_1 y_0^2\alpha_0^4 + \tfrac{1}{2}d_1 y_0 \alpha_0^4 - \tfrac{8}{9}d_1 y_0^3\alpha_0^3 + 3d_1 y_0^2\alpha_0^3 - \tfrac{10}{3}d_1 y_0\alpha_0^3 + 2d_1 y_0^3\alpha_0^2 - \tfrac{15}{2}d_1 y_0^2\alpha_0^2 + 10 d_1 y_0\alpha_0^2 - \\
&\tfrac{8}{3}d_1 y_0^3\alpha_0 + 11 d_1 y_0^2\alpha_0 - 18 d_1 y_0\alpha_0 + \tfrac{25 d_1 y_0^3}{18} - 6 d_1 y_0^2 + \tfrac{65 d_1 y_0}{6}\Big) H(1;\alpha_0) - \tfrac{1}{24}\pi^2 H(1;Y) + \Big(\tfrac{y_0^3\alpha_0^4}{12} - \tfrac{y_0^2\alpha_0^4}{4} + \\
&\tfrac{y_0\alpha_0^4}{4} - \tfrac{\alpha_0^4}{12} - \tfrac{4y_0^3\alpha_0^3}{9} + \tfrac{3y_0^2\alpha_0^3}{2} - \tfrac{5y_0\alpha_0^3}{3} + \tfrac{11\alpha_0^3}{18} + y_0^3\alpha_0^2 - \tfrac{15y_0^2\alpha_0^2}{4} + 5y_0\alpha_0^2 - \tfrac{9\alpha_0^2}{4} - \tfrac{4y_0^3\alpha_0}{3} + \tfrac{11y_0^2\alpha_0}{2} + 2d_1\alpha_0 - \\
&d_1'\alpha_0 - 9y_0\alpha_0 + H(0;Y)\alpha_0 - \alpha_0 + \tfrac{25y_0^3}{36} - \tfrac{8y_0^2}{3} - 2d_1 + d_1' + \tfrac{49y_0}{12} + \Big(2\alpha_0 - \tfrac{2}{y_0-1} - 2\Big) H(0;\alpha_0) - \tfrac{H(0;Y)}{y_0-1} - \\
&H(0;Y) + \Big(2\alpha_0 d_1 - \tfrac{2d_1}{y_0-1} - 2d_1\Big)H(1;\alpha_0) - \tfrac{2d_1}{y_0-1} + \tfrac{d_1'}{y_0-1} + \tfrac{61}{12(y_0-1)} + \tfrac{61}{12}\Big) H(c_1(\alpha_0);y_0) + \Big(\tfrac{2y_0^3}{3} - 3y_0^2 + \\
&6y_0 - \tfrac{2}{y_0-1} - 2\Big) H(0,0;\alpha_0) + \tfrac{1}{3}y_0^3 H(0,0;Y) - \tfrac{3}{2}y_0^2 H(0,0;Y) + 3y_0 H(0,0;Y) + \tfrac12 H(0,0;Y) + \Big(\tfrac{10y_0^3}{3} - \\
&15y_0^2 + 30y_0 - 4H(0;Y) + \tfrac{6}{y_0-1} + 14\Big) H(0,0;y_0) + \Big(\tfrac{2d_1 y_0^3}{3} - 3d_1y_0^2 + 6d_1y_0 - 2d_1 - \tfrac{2d_1}{y_0-1}\Big)H(0,1;\alpha_0) + \\
&H(1;y_0)\Big(\tfrac{1}{12}d_1'y_0^3\alpha_0^4 - \tfrac14 d_1' y_0^2\alpha_0^4 - \tfrac{d_1'\alpha_0^4}{12} + \tfrac14 d_1' y_0\alpha_0^4 - \tfrac49 d_1' y_0^3\alpha_0^3 + \tfrac32 d_1' y_0^2\alpha_0^3 + \tfrac{11 d_1'\alpha_0^3}{18} - \tfrac53 d_1' y_0\alpha_0^3 + \\
&d_1' y_0^3\alpha_0^2 - \tfrac{15}{4}d_1'y_0^2\alpha_0^2 - \tfrac{9d_1'\alpha_0^2}{4} + 5d_1'y_0\alpha_0^2 - \tfrac43 d_1'y_0^3\alpha_0 + \tfrac{11}{2}d_1'y_0^2\alpha_0 + \tfrac{23 d_1'\alpha_0}{6} - 9d_1'y_0\alpha_0 + \tfrac{d_1'^2 y_0^3}{9} - d_1' y_0^3 - \\
&\tfrac{49 d_1'^2}{36} - \tfrac{7d_1'^2 y_0^2}{12} + \tfrac{21 d_1' y_0^2}{4} + \tfrac{43 d_1'}{4} + \tfrac{11 d_1'^2 y_0}{6} - 15 d_1' y_0 + \tfrac13 d_1' y_0^3 H(0;Y) - \tfrac32 d_1' y_0^2 H(0;Y) - \tfrac{11}{6}d_1' H(0;Y) + \\
&3d_1'y_0 H(0;Y) + H(0;\alpha_0)\Big(\tfrac{d_1'y_0^3}{3} - \tfrac{y_0^3}{3} - \tfrac{3d_1'y_0^2}{2} + \tfrac{3y_0^2}{2} + 3d_1'y_0 - 3y_0 - \tfrac{11d_1'}{6} + H(0;Y) + \tfrac{2d_1}{y_0-1} - \tfrac{d_1'}{y_0-1} - \\
&\tfrac{1}{y_0-1} - 5\Big) + 2H(0,0;\alpha_0) + 2d_1 H(0,1;\alpha_0) - \tfrac{\pi^2}{6}\Big) + \Big(d_1'y_0^3 - \tfrac{9d_1'y_0^2}{2} + 9d_1'y_0 + 3d_1' + (2-2d_1)H(0;\alpha_0) - \\
&d_1' H(0;Y) + \tfrac{d_1'}{y_0-1}\Big) H(0,1;y_0) + \Big(-\tfrac{y_0^3}{3} + \tfrac{3y_0^2}{2} - 3y_0 + 2H(0;\alpha_0) + H(0;Y) + 2d_1 H(1;\alpha_0) - \tfrac{3}{y_0-1} - \\
&5\Big) H(0,c_1(\alpha_0);y_0) + H(0;y_0)\Big(\tfrac{y_0^3\alpha_0^4}{6} - \tfrac{y_0^2\alpha_0^4}{2} + \tfrac{y_0\alpha_0^4}{2} - \tfrac{8y_0^3\alpha_0^3}{9} + 3y_0^2\alpha_0^3 - \tfrac{10y_0\alpha_0^3}{3} + 2y_0^3\alpha_0^2 - \tfrac{15y_0^2\alpha_0^2}{2} + \\
&10y_0\alpha_0^2 - \tfrac{8y_0^3\alpha_0}{3} + 11y_0^2\alpha_0 - 18y_0\alpha_0 + \tfrac{d_1'y_0^3}{3} - \tfrac{133y_0^3}{36} - \tfrac{7d_1'y_0^2}{4} + \tfrac{221y_0^2}{12} + 2d_1 - d_1' + \tfrac{11d_1'y_0}{2} - \tfrac{589y_0}{12} + \Big(\tfrac{2y_0^3}{3} - 3y_0^2 + \\
&6y_0 - \tfrac{2}{y_0-1} - 2\Big)H(0;\alpha_0) + y_0^3 H(0;Y) - \tfrac92 y_0^2 H(0;Y) + 9y_0 H(0;Y) + \tfrac{H(0;Y)}{y_0-1} + 3H(0;Y) - H(0,0;Y) - \\
&H(1,0;Y) + \tfrac{2d_1}{y_0-1} - \tfrac{d_1'}{y_0-1} - \tfrac{61}{12(y_0-1)} - \tfrac{\pi^2}{6} - \tfrac{109}{12}\Big) + \tfrac13 y_0^3 H(1,0;Y) - \tfrac32 y_0^2 H(1,0;Y) + 3y_0 H(1,0;Y) + \\
&\tfrac12 H(1,0;Y) + \Big(d_1'y_0^3 + \tfrac{y_0^3}{3} - \tfrac{9d_1'y_0^2}{2} - \tfrac{3y_0^2}{2} + 9d_1'y_0 + 3y_0 - \tfrac{11d_1'}{2} + 2H(0;\alpha_0) - H(0;Y) - \tfrac{2d_1}{y_0-1} + \tfrac{d_1'}{y_0-1} + \tfrac{1}{y_0-1} + \\
&5\Big) H(1,0;y_0) + \Big(\tfrac{d_1'^2 y_0^3}{3} - \tfrac{3d_1'^2 y_0^2}{2} + 3d_1'^2 y_0 - \tfrac{11 d_1'^2}{6} + (-2d_1 + d_1' + 1)H(0;\alpha_0)\Big) H(1,1;y_0) + \Big(-\tfrac{y_0^3}{3} + \tfrac{3y_0^2}{2} - \\
&3y_0 + 2H(0;\alpha_0) + H(0;Y) + 2d_1 H(1;\alpha_0) + \tfrac{2d_1}{y_0-1} - \tfrac{d_1'}{y_0-1} - \tfrac{1}{y_0-1} - 5\Big) H(1,c_1(\alpha_0);y_0) + \Big(2\alpha_0 - \tfrac{2}{y_0-1} - \\
&2\Big) H(c_1(\alpha_0),0;y_0) + \Big(\alpha_0 d_1' - \tfrac{d_1'}{y_0-1} - d_1'\Big) H(c_1(\alpha_0),1;y_0) + \Big(\alpha_0 - \tfrac{1}{y_0-1} - 1\Big) H(c_1(\alpha_0),c_1(\alpha_0);y_0) - \\
&\tfrac14 H(0,0,0;Y) - 16H(0,0,0;y_0) - 4d_1'H(0,0,1;y_0) + 4H(0,0,c_1(\alpha_0);y_0) - \tfrac14 H(0,1,0;Y) + (2d_1 - \\
&4d_1' - 2)H(0,1,0;y_0) - d_1'^2 H(0,1,1;y_0) + (-2d_1 + d_1' + 2)H(0,1,c_1(\alpha_0);y_0) + 2H(0,c_1(\alpha_0),0;y_0) + \\
&d_1' H(0,c_1(\alpha_0),1;y_0) + H(0,c_1(\alpha_0),c_1(\alpha_0);y_0) - \tfrac14 H(1,0,0;Y) - 6H(1,0,0;y_0) - d_1'H(1,0,1;y_0) + \\
&3H(1,0,c_1(\alpha_0);y_0) - \tfrac14 H(1,1,0;Y) + (2d_1 - d_1' - 1)H(1,1,0;y_0) + (-2d_1 + d_1' + 1)H(1,1,c_1(\alpha_0);y_0) + \\
&2H(1,c_1(\alpha_0),0;y_0) + d_1' H(1,c_1(\alpha_0),1;y_0) + H(1,c_1(\alpha_0),c_1(\alpha_0);y_0) + \tfrac{\pi^2}{6(y_0-1)} - \tfrac{3\zeta_3}{2} + \tfrac{\pi^2}{4} + 2.
\end{aligned}
$$

F.3 The $\mathcal{J}{*}\mathcal{I}$ integral for $k = 2$

The ε expansion for this integral reads

$$
\mathcal{J}{*}\mathcal{I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;2) = \frac{1}{\varepsilon^3}(j*i)^{(2)}_{-3} + \frac{1}{\varepsilon^2}(j*i)^{(2)}_{-2} + \frac{1}{\varepsilon}(j*i)^{(2)}_{-1} + (j*i)^{(2)}_{0} + \mathcal{O}(\varepsilon)\,, \qquad (F.3)
$$

where

$$
(j*i)^{(2)}_{-3} = \tfrac{1}{6},
$$

$$
(j*i)^{(2)}_{-2} = \tfrac{2y_0^3}{9} - y_0^2 + 2y_0 - \tfrac{1}{6}H(0;Y) - \tfrac{2}{3}H(0;y_0) + \tfrac{4}{9},
$$

$$
\begin{aligned}
&(j*i)^{(2)}_{-1} = -\tfrac{1}{18}y_0^3\alpha_0^4+\tfrac{y_0^2\alpha_0^4}{12}-\tfrac{y_0\alpha_0^4}{3}+\tfrac{\alpha_0^4}{6(y_0-2)}+\tfrac{\alpha_0^4}{12}+\tfrac{8y_0^3\alpha_0^3}{27}-\tfrac{2y_0^2\alpha_0^3}{3}+\tfrac{8y_0\alpha_0^3}{9}+\tfrac{\alpha_0^3}{y_0-2}+\tfrac{4\alpha_0^3}{9(y_0-2)^2}+\\
&\tfrac{7\alpha_0^3}{18}-\tfrac{2y_0^3\alpha_0^2}{3}+2y_0^2\alpha_0^2-\tfrac{5y_0\alpha_0^2}{3}+\tfrac{8\alpha_0^2}{3(y_0-2)}+\tfrac{11\alpha_0^2}{3(y_0-2)^2}+\tfrac{4\alpha_0^2}{3(y_0-2)^3}+\tfrac{7\alpha_0^2}{12}+\tfrac{8y_0^3\alpha_0}{9}-\tfrac{10y_0^2\alpha_0}{3}+4y_0\alpha_0+\\
&\tfrac{13\alpha_0}{3(y_0-2)}+\tfrac{18\alpha_0}{(y_0-2)^2}+\tfrac{52\alpha_0}{3(y_0-2)^3}+\tfrac{16\alpha_0}{3(y_0-2)^4}-\tfrac{\alpha_0}{2}-\tfrac{2d_1'y_0^3}{27}+\tfrac{19y_0^3}{27}+\tfrac{7d_1'y_0^2}{18}-\tfrac{11y_0^2}{3}-\tfrac{11d_1'y_0}{9}+\tfrac{31y_0}{3}+\Big(-\tfrac{2y_0^3}{9}+y_0^2-\\
&2y_0+\tfrac{2}{3(y_0-1)}+\tfrac{80}{3(y_0-2)^2}+\tfrac{160}{3(y_0-2)^3}+\tfrac{40}{(y_0-2)^4}+\tfrac{32}{3(y_0-2)^5}-\tfrac{3}{2}\Big)H(0;\alpha_0)-\tfrac{2}{9}y_0^3H(0;Y)+y_0^2H(0;Y)-\\
&2y_0H(0;Y)-\tfrac{4}{9}H(0;Y)+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6y_0+\tfrac{2}{3}H(0;Y)-\tfrac{2}{3(y_0-1)}-\tfrac{80}{3(y_0-2)^2}-\tfrac{160}{3(y_0-2)^3}-\tfrac{40}{(y_0-2)^4}-\\
&\tfrac{32}{3(y_0-2)^5}-\tfrac{5}{18}\Big)H(0;y_0)+\Big(-\tfrac{2d_1'y_0^3}{9}+d_1'y_0^2-2d_1'y_0+\tfrac{11d_1'}{9}-\tfrac{2}{3}H(0;\alpha_0)\Big)H(1;y_0)+\Big(-\tfrac{2\alpha_0}{3}+\\
&\tfrac{2}{3(y_0-1)}+\tfrac{2}{3}\Big)H(c_1(\alpha_0);y_0)+\Big(-\tfrac{\alpha_0^4}{2}-\tfrac{2\alpha_0^3}{3}+\alpha_0^2+2\alpha_0+\tfrac{80}{3(y_0-2)^2}+\tfrac{160}{3(y_0-2)^3}+\tfrac{40}{(y_0-2)^4}+\tfrac{32}{3(y_0-2)^5}-\\
&\tfrac{11}{6}\Big)H(c_2(\alpha_0);y_0)+\tfrac{1}{6}H(0,0;Y)+\tfrac{8}{3}H(0,0;y_0)+\tfrac{2}{3}d_1'H(0,1;y_0)-\tfrac{2}{3}H(0,c_1(\alpha_0);y_0)+\tfrac{1}{6}H(1,0;Y)+\\
&\tfrac{2}{3}H(1,0;y_0)-\tfrac{2}{3}H(1,c_1(\alpha_0);y_0)+\tfrac{80\ln 2}{3(y_0-2)^2}+\tfrac{160\ln 2}{3(y_0-2)^3}+\tfrac{40\ln 2}{(y_0-2)^4}+\tfrac{32\ln 2}{3(y_0-2)^5}-\tfrac{13\ln 2}{6}+\tfrac{\pi^2}{36}+\tfrac{26}{27},
\end{aligned}
$$

$$
\begin{aligned}
&(j*i)^{(2)}_{0} = \tfrac{1}{36}d_1y_0^3\alpha_0^4+\tfrac{1}{54}d_1'y_0^3\alpha_0^4-\tfrac{11y_0^3\alpha_0^4}{54}-\tfrac{1}{24}d_1y_0^2\alpha_0^4-\tfrac{1}{72}d_1'y_0^2\alpha_0^4+\tfrac{5y_0^2\alpha_0^4}{18}-\tfrac{d_1\alpha_0^4}{24}+\tfrac{1}{6}d_1y_0\alpha_0^4+\\
&\tfrac{11}{36}d_1'y_0\alpha_0^4-\tfrac{35y_0\alpha_0^4}{18}+\tfrac{1}{18}y_0^3H(0;Y)\alpha_0^4-\tfrac{1}{12}y_0^2H(0;Y)\alpha_0^4+\tfrac{1}{3}y_0H(0;Y)\alpha_0^4-\tfrac{H(0;Y)\alpha_0^4}{6(y_0-2)}-\tfrac{1}{12}H(0;Y)\alpha_0^4-\\
&\tfrac{d_1\alpha_0^4}{12(y_0-2)}+\tfrac{19\alpha_0^4}{36(y_0-2)}+\tfrac{19\alpha_0^4}{72}-\tfrac{13}{81}d_1y_0^3\alpha_0^3-\tfrac{8}{81}d_1'y_0^3\alpha_0^3+\tfrac{181y_0^3\alpha_0^3}{162}+\tfrac{7}{18}d_1y_0^2\alpha_0^3+\tfrac{5}{27}d_1'y_0^2\alpha_0^3-\tfrac{281y_0^2\alpha_0^3}{108}-\\
&\tfrac{43d_1\alpha_0^3}{108}+\tfrac{d_1'\alpha_0^3}{18}-\tfrac{10}{27}d_1y_0\alpha_0^3-\tfrac{14}{27}d_1'y_0\alpha_0^3+\tfrac{493y_0\alpha_0^3}{108}-\tfrac{8}{27}y_0^3H(0;Y)\alpha_0^3+\tfrac{2}{3}y_0^2H(0;Y)\alpha_0^3-\tfrac{8}{9}y_0H(0;Y)\alpha_0^3-\\
&\tfrac{H(0;Y)\alpha_0^3}{y_0-2}-\tfrac{4H(0;Y)\alpha_0^3}{9(y_0-2)^2}-\tfrac{7}{18}H(0;Y)\alpha_0^3-\tfrac{17d_1\alpha_0^3}{18(y_0-2)}+\tfrac{d_1'\alpha_0^3}{9(y_0-2)}+\tfrac{61\alpha_0^3}{18(y_0-2)}-\tfrac{8d_1\alpha_0^3}{27(y_0-2)^2}+\tfrac{40\alpha_0^3}{27(y_0-2)^2}+\tfrac{143\alpha_0^3}{108}+\\
&\tfrac{23}{54}d_1y_0^3\alpha_0^2+\tfrac{2}{9}d_1'y_0^3\alpha_0^2-\tfrac{287y_0^3\alpha_0^2}{108}-\tfrac{17}{12}d_1y_0^2\alpha_0^2-\tfrac{2}{3}d_1'y_0^2\alpha_0^2+\tfrac{1883y_0^2\alpha_0^2}{216}-\tfrac{113d_1\alpha_0^2}{72}+\tfrac{13d_1'\alpha_0^2}{36}+\tfrac{10}{9}d_1y_0\alpha_0^2+\\
&\tfrac{1}{3}d_1'y_0\alpha_0^2-\tfrac{224y_0\alpha_0^2}{27}+\tfrac{2}{3}y_0^3H(0;Y)\alpha_0^2-2y_0^2H(0;Y)\alpha_0^2+\tfrac{5}{3}y_0H(0;Y)\alpha_0^2-\tfrac{8H(0;Y)\alpha_0^2}{3(y_0-2)}-\tfrac{11H(0;Y)\alpha_0^2}{3(y_0-2)^2}-\\
&\tfrac{4H(0;Y)\alpha_0^2}{3(y_0-2)^3}-\tfrac{7}{12}H(0;Y)\alpha_0^2-\tfrac{46d_1\alpha_0^2}{9(y_0-2)}+\tfrac{8d_1'\alpha_0^2}{9(y_0-2)}+\tfrac{179\alpha_0^2}{18(y_0-2)}-\tfrac{83d_1\alpha_0^2}{18(y_0-2)^2}+\tfrac{d_1'\alpha_0^2}{3(y_0-2)^2}+\tfrac{247\alpha_0^2}{18(y_0-2)^2}-\tfrac{4d_1\alpha_0^2}{3(y_0-2)^3}+\\
&\tfrac{44\alpha_0^2}{9(y_0-2)^3}+\tfrac{155\alpha_0^2}{72}-\tfrac{25}{27}d_1y_0^3\alpha_0-\tfrac{8}{27}d_1'y_0^3\alpha_0+\tfrac{25y_0^3\alpha_0}{6}+\tfrac{23}{6}d_1y_0^2\alpha_0+\tfrac{11}{9}d_1'y_0^2\alpha_0-\tfrac{1883y_0^2\alpha_0}{108}-\tfrac{83d_1\alpha_0}{36}+\tfrac{19d_1'\alpha_0}{18}-\\
&\tfrac{52d_1y_0\alpha_0}{9}-\tfrac{14d_1'y_0\alpha_0}{9}+\tfrac{949y_0\alpha_0}{36}-\tfrac{8}{9}y_0^3H(0;Y)\alpha_0+\tfrac{10}{3}y_0^2H(0;Y)\alpha_0-4y_0H(0;Y)\alpha_0-\tfrac{13H(0;Y)\alpha_0}{3(y_0-2)}-\\
&\tfrac{18H(0;Y)\alpha_0}{(y_0-2)^2}-\tfrac{52H(0;Y)\alpha_0}{3(y_0-2)^3}-\tfrac{16H(0;Y)\alpha_0}{3(y_0-2)^4}+\tfrac{1}{2}H(0;Y)\alpha_0-\tfrac{383d_1\alpha_0}{18(y_0-2)}+\tfrac{35d_1'\alpha_0}{9(y_0-2)}+\tfrac{113\alpha_0}{6(y_0-2)}-\tfrac{151d_1\alpha_0}{3(y_0-2)^2}+\tfrac{38d_1'\alpha_0}{9(y_0-2)^2}+\\
&\tfrac{263\alpha_0}{3(y_0-2)^2}-\tfrac{118d_1\alpha_0}{3(y_0-2)^3}+\tfrac{4d_1'\alpha_0}{3(y_0-2)^3}+\tfrac{746\alpha_0}{9(y_0-2)^3}-\tfrac{32d_1\alpha_0}{3(y_0-2)^4}+\tfrac{224\alpha_0}{9(y_0-2)^4}-\tfrac{133\alpha_0}{36}+\tfrac{2d_1'^2y_0^3}{81}-\tfrac{25d_1'y_0^3}{81}+\tfrac{137y_0^3}{81}-\\
&\tfrac{17d_1'^2y_0^2}{108}+\tfrac{223d_1'y_0^2}{108}-\tfrac{179y_0^2}{18}+\tfrac{49d_1'^2y_0}{54}-\tfrac{298d_1'y_0}{27}+\tfrac{359y_0}{9}+\tfrac{2}{27}d_1'y_0^3H(0;Y)-\tfrac{19}{27}y_0^3H(0;Y)-\tfrac{7}{18}d_1'y_0^2H(0;Y)+\\
&\tfrac{11}{3}y_0^2H(0;Y)+\tfrac{11}{9}d_1'y_0H(0;Y)-\tfrac{31}{3}y_0H(0;Y)-\tfrac{1}{36}\pi^2H(0;Y)-\tfrac{26}{27}H(0;Y)+H(0;\alpha_0)\Big(\tfrac{y_0^3\alpha_0^4}{9}-\tfrac{y_0^2\alpha_0^4}{6}+\\
&\tfrac{2y_0\alpha_0^4}{3}-\tfrac{\alpha_0^4}{3(y_0-2)}-\tfrac{\alpha_0^4}{6}-\tfrac{16y_0^3\alpha_0^3}{27}+\tfrac{4y_0^2\alpha_0^3}{3}-\tfrac{16y_0\alpha_0^3}{9}-\tfrac{2\alpha_0^3}{y_0-2}-\tfrac{8\alpha_0^3}{9(y_0-2)^2}-\tfrac{7\alpha_0^3}{9}+\tfrac{4y_0^3\alpha_0^2}{3}-4y_0^2\alpha_0^2+\tfrac{10y_0\alpha_0^2}{3}-\\
&\tfrac{16\alpha_0^2}{3(y_0-2)}-\tfrac{22\alpha_0^2}{3(y_0-2)^2}-\tfrac{8\alpha_0^2}{3(y_0-2)^3}-\tfrac{7\alpha_0^2}{6}-\tfrac{16y_0^3\alpha_0}{9}+\tfrac{20y_0^2\alpha_0}{3}-8y_0\alpha_0-\tfrac{26\alpha_0}{3(y_0-2)}-\tfrac{36\alpha_0}{(y_0-2)^2}-\tfrac{104\alpha_0}{3(y_0-2)^3}-\tfrac{32\alpha_0}{3(y_0-2)^4}+\\
&\alpha_0+\tfrac{2d_1'y_0^3}{27}-\tfrac{13y_0^3}{54}-\tfrac{7d_1'y_0^2}{18}+\tfrac{71y_0^2}{36}+\tfrac{41d_1}{36}+\tfrac{d_1'}{18}+\tfrac{11d_1'y_0}{9}-\tfrac{25y_0}{3}+\tfrac{2}{9}y_0^3H(0;Y)-y_0^2H(0;Y)+2y_0H(0;Y)-\\
&\tfrac{2H(0;Y)}{3(y_0-1)}-\tfrac{80H(0;Y)}{3(y_0-2)^2}-\tfrac{160H(0;Y)}{3(y_0-2)^3}-\tfrac{40H(0;Y)}{(y_0-2)^4}-\tfrac{32H(0;Y)}{3(y_0-2)^5}+\tfrac{3}{2}H(0;Y)+\tfrac{8d_1'}{3(y_0-2)}-\tfrac{20}{3(y_0-2)}-\tfrac{4d_1}{3(y_0-1)}+\\
&\tfrac{2d_1'}{3(y_0-1)}+\tfrac{7}{2(y_0-1)}-\tfrac{16d_1}{(y_0-2)^2}+\tfrac{12d_1'}{(y_0-2)^2}+\tfrac{88}{(y_0-2)^2}-\tfrac{128d_1}{9(y_0-2)^3}+\tfrac{88d_1'}{9(y_0-2)^3}+\tfrac{168}{(y_0-2)^3}-\tfrac{4d_1}{(y_0-2)^4}+\tfrac{8d_1'}{3(y_0-2)^4}+\\
&\tfrac{116}{(y_0-2)^4}+\tfrac{256}{9(y_0-2)^5}-\tfrac{259}{36}\Big)+\Big(\tfrac{1}{9}d_1y_0^3\alpha_0^4-\tfrac{1}{6}d_1y_0^2\alpha_0^4-\tfrac{d_1\alpha_0^4}{6}+\tfrac{2}{3}d_1y_0\alpha_0^4-\tfrac{d_1\alpha_0^4}{3(y_0-2)}-\tfrac{16}{27}d_1y_0^3\alpha_0^3+\tfrac{4}{3}d_1y_0^2\alpha_0^3-\\
&\tfrac{7d_1\alpha_0^3}{9}-\tfrac{16}{9}d_1y_0\alpha_0^3-\tfrac{2d_1\alpha_0^3}{y_0-2}-\tfrac{8d_1\alpha_0^3}{9(y_0-2)^2}+\tfrac{4}{3}d_1y_0^3\alpha_0^2-4d_1y_0^2\alpha_0^2-\tfrac{7d_1\alpha_0^2}{6}+\tfrac{10}{3}d_1y_0\alpha_0^2-\tfrac{16d_1\alpha_0^2}{3(y_0-2)}-\tfrac{22d_1\alpha_0^2}{3(y_0-2)^2}-\\
&\tfrac{8d_1\alpha_0^2}{3(y_0-2)^3}-\tfrac{16}{9}d_1y_0^3\alpha_0+\tfrac{20}{3}d_1y_0^2\alpha_0+d_1\alpha_0-8d_1y_0\alpha_0-\tfrac{26d_1\alpha_0}{3(y_0-2)}-\tfrac{36d_1\alpha_0}{(y_0-2)^2}-\tfrac{104d_1\alpha_0}{3(y_0-2)^3}-\tfrac{32d_1\alpha_0}{3(y_0-2)^4}+\tfrac{25d_1y_0^3}{27}-\\
&\tfrac{23d_1y_0^2}{6}+\tfrac{10d_1}{9}+\tfrac{52d_1y_0}{9}+\tfrac{49d_1}{3(y_0-2)}+\tfrac{398d_1}{9(y_0-2)^2}+\tfrac{112d_1}{3(y_0-2)^3}+\tfrac{32d_1}{3(y_0-2)^4}\Big)H(1;\alpha_0)-\tfrac{1}{36}\pi^2H(1;Y)+\Big(\tfrac{y_0^3\alpha_0^4}{18}-
\end{aligned}
$$

$$\frac{y_0^2\alpha_0^4}{12}+\frac{y_0\alpha_0^4}{3}-\frac{\alpha_0^4}{6(y_0-2)}-\frac{17\alpha_0^4}{36}-\frac{8y_0^3\alpha_0^3}{27}+\frac{2y_0^2\alpha_0^3}{3}-\frac{8y_0\alpha_0^3}{9}-\frac{\alpha_0^3}{y_0-2}-\frac{4\alpha_0^3}{9(y_0-2)^2}-\frac{29\alpha_0^3}{54}+\frac{2y_0^3\alpha_0^2}{3}-2y_0^2\alpha_0^2+\frac{5y_0\alpha_0^2}{3}-$$
$$\frac{8\alpha_0^2}{3(y_0-2)}-\frac{11\alpha_0^2}{3(y_0-2)^2}-\frac{4\alpha_0^2}{3(y_0-2)^3}-\frac{13\alpha_0^2}{12}-\frac{8y_0^3\alpha_0}{9}+\frac{10y_0^2\alpha_0}{3}+\frac{4d_1\alpha_0}{3}-\frac{2d_1'\alpha_0}{3}-4y_0\alpha_0+\frac{2}{3}H(0;Y)\alpha_0-\frac{13\alpha_0}{3(y_0-2)}-$$
$$\frac{18\alpha_0}{(y_0-2)^2}-\frac{52\alpha_0}{3(y_0-2)^3}-\frac{16\alpha_0}{3(y_0-2)^4}+\frac{7\alpha_0}{18}+\frac{25y_0^3}{54}-\frac{61y_0^2}{36}-\frac{4d_1}{3}+\frac{2d_1'}{3}+2y_0+\left(\frac{4\alpha_0}{3}-\frac{4}{3(y_0-1)}-\frac{4}{3}\right)H(0;\alpha_0)-$$
$$\frac{2H(0;Y)}{3(y_0-1)}-\frac{2}{3}H(0;Y)+\left(\frac{4\alpha_0 d_1}{3}-\frac{4d_1}{3(y_0-1)}-\frac{4d_1}{3}\right)H(1;\alpha_0)+\frac{32}{3(y_0-2)}-\frac{4d_1}{3(y_0-1)}+\frac{2d_1'}{3(y_0-1)}+\frac{7}{2(y_0-1)}+$$
$$\frac{332}{9(y_0-2)^2}+\frac{104}{3(y_0-2)^3}+\frac{32}{3(y_0-2)^4}+\frac{59}{18}\Big)H(c_1(\alpha_0);y_0)+\Big(\frac{d_1\alpha_0^4}{4}-\frac{d_1'\alpha_0^4}{6}+\frac{1}{2}H(0;Y)\alpha_0^4-\frac{5\alpha_0^4}{4}+\frac{7d_1\alpha_0^3}{9}-\frac{5d_1'\alpha_0^3}{9}+$$
$$\frac{2}{3}H(0;Y)\alpha_0^3-\alpha_0^3+\frac{d_1\alpha_0^2}{6}-\frac{d_1'\alpha_0^2}{3}-H(0;Y)\alpha_0^2+\frac{29\alpha_0^2}{6}-\frac{11d_1\alpha_0}{3}+\frac{5d_1'\alpha_0}{3}-2H(0;Y)\alpha_0+7\alpha_0+\frac{89d_1}{36}-$$
$$\frac{11d_1'}{18}+\Big(\alpha_0^4+\frac{4\alpha_0^3}{3}-2\alpha_0^2-4\alpha_0-\frac{160}{3(y_0-2)^2}-\frac{320}{3(y_0-2)^3}-\frac{80}{(y_0-2)^4}-\frac{64}{3(y_0-2)^5}+\frac{11}{3}\Big)H(0;\alpha_0)-\frac{80H(0;Y)}{3(y_0-2)^2}-$$
$$\frac{160H(0;Y)}{3(y_0-2)^3}-\frac{40H(0;Y)}{(y_0-2)^4}-\frac{32H(0;Y)}{3(y_0-2)^5}+\frac{11}{6}H(0;Y)+\Big(d_1\alpha_0^4+\frac{4d_1\alpha_0^3}{3}-2d_1\alpha_0^2-4d_1\alpha_0+\frac{11d_1}{3}-\frac{160d_1}{3(y_0-2)^2}-$$
$$\frac{320d_1}{3(y_0-2)^3}-\frac{80d_1}{(y_0-2)^4}-\frac{64d_1}{3(y_0-2)^5}\Big)H(1;\alpha_0)+\frac{8d_1'}{3(y_0-2)}-\frac{52}{3(y_0-2)}-\frac{16d_1}{(y_0-2)^2}+\frac{12d_1'}{(y_0-2)^2}+\frac{460}{9(y_0-2)^2}-\frac{128d_1}{9(y_0-2)^3}+$$
$$\frac{88d_1'}{9(y_0-2)^3}+\frac{400}{3(y_0-2)^3}-\frac{4d_1}{(y_0-2)^4}+\frac{8d_1'}{3(y_0-2)^4}+\frac{316}{3(y_0-2)^4}+\frac{256}{9(y_0-2)^5}-\frac{115}{12}\Big)H(c_2(\alpha_0);y_0)+\Big(\frac{4y_0^3}{9}-2y_0^2+4y_0-$$
$$\frac{4}{3(y_0-1)}-\frac{160}{3(y_0-2)^2}-\frac{320}{3(y_0-2)^3}-\frac{80}{(y_0-2)^4}-\frac{64}{3(y_0-2)^5}+3\Big)H(0,0;\alpha_0)+\frac{2}{9}y_0^3H(0,0;Y)-y_0^2H(0,0;Y)+$$
$$2y_0H(0,0;Y)+\frac{4}{9}H(0,0;Y)+\Big(\frac{20y_0^3}{9}-10y_0^2+20y_0-\frac{8}{3}H(0;Y)+\frac{4}{y_0-1}+\frac{160}{(y_0-2)^2}+\frac{320}{(y_0-2)^3}+$$
$$\frac{240}{(y_0-2)^4}+\frac{64}{(y_0-2)^5}-\frac{17}{9}\Big)H(0,0;y_0)+\Big(\frac{4d_1y_0^3}{9}-2d_1y_0^2+4d_1y_0+3d_1-\frac{4d_1}{3(y_0-1)}-\frac{160d_1}{3(y_0-2)^2}-\frac{320d_1}{3(y_0-2)^3}-$$
$$\frac{80d_1}{(y_0-2)^4}-\frac{64d_1}{3(y_0-2)^5}\Big)H(0,1;\alpha_0)+\Big(\frac{2d_1'y_0^3}{3}-3d_1'y_0^2+6d_1'y_0+\frac{5d_1'}{18}+\Big(\frac{4}{3}-\frac{4d_1}{3}\Big)H(0;\alpha_0)-\frac{2}{3}d_1'H(0;Y)+$$
$$\frac{2d_1'}{3(y_0-1)}+\frac{80d_1'}{3(y_0-2)^2}+\frac{160d_1'}{3(y_0-2)^3}+\frac{40d_1'}{(y_0-2)^4}+\frac{32d_1'}{3(y_0-2)^5}\Big)H(0,1;y_0)+\Big(-\frac{2y_0^3}{9}+y_0^2-2y_0+\frac{4}{3}H(0;\alpha_0)+$$
$$\frac{2}{3}H(0;Y)+\frac{4}{3}d_1H(1;\alpha_0)-\frac{2}{y_0-1}+\frac{80}{3(y_0-2)^2}+\frac{160}{3(y_0-2)^3}+\frac{40}{(y_0-2)^4}+\frac{32}{3(y_0-2)^5}-\frac{107}{18}\Big)H(0,c_1(\alpha_0);y_0)+$$
$$\Big(\frac{26}{3}-\frac{320}{3(y_0-2)^2}-\frac{640}{3(y_0-2)^3}-\frac{160}{(y_0-2)^4}-\frac{128}{3(y_0-2)^5}\Big)H(0,c_2(\alpha_0);y_0)+\frac{2}{9}y_0^3H(1,0;Y)-y_0^2H(1,0;Y)+$$
$$2y_0H(1,0;Y)+\frac{4}{9}H(1,0;Y)+\Big(\frac{2d_1'y_0^3}{3}+\frac{2y_0^3}{9}-3d_1'y_0^2-y_0^2+6d_1'y_0+2y_0-\frac{19d_1'}{3}+\frac{4}{3}H(0;\alpha_0)-\frac{2}{3}H(0;Y)-$$
$$\frac{4d_1}{3(y_0-1)}+\frac{2d_1'}{3(y_0-1)}+\frac{2}{3(y_0-1)}+\frac{80d_1'}{3(y_0-2)^2}-\frac{80}{3(y_0-2)^2}+\frac{160d_1'}{3(y_0-2)^3}-\frac{160}{3(y_0-2)^3}+\frac{40d_1'}{(y_0-2)^4}-\frac{40}{(y_0-2)^4}+\frac{32d_1'}{3(y_0-2)^5}-$$
$$\frac{32}{3(y_0-2)^5}+\frac{107}{18}\Big)H(1,0;y_0)+\Big(\frac{2d_1'^2y_0^3}{9}-d_1'^2y_0^2+2d_1'^2y_0-\frac{11d_1'^2}{9}+\Big(-\frac{4d_1}{3}+\frac{2d_1'}{3}+\frac{2}{3}\Big)H(0;\alpha_0)\Big)H(1,1;y_0)+$$
$$\Big(-\frac{2y_0^3}{9}+y_0^2-2y_0+\frac{4}{3}H(0;\alpha_0)+\frac{2}{3}H(0;Y)+\frac{4}{3}d_1H(1;\alpha_0)+\frac{4d_1}{3(y_0-1)}-\frac{2d_1'}{3(y_0-1)}-\frac{2}{3(y_0-1)}+\frac{80}{3(y_0-2)^2}+$$
$$\frac{160}{3(y_0-2)^3}+\frac{40}{(y_0-2)^4}+\frac{32}{3(y_0-2)^5}-\frac{107}{18}\Big)H(1,c_1(\alpha_0);y_0)+\Big(-\frac{80d_1'}{3(y_0-2)^2}-\frac{160d_1'}{3(y_0-2)^3}-\frac{40d_1'}{(y_0-2)^4}-\frac{32d_1'}{3(y_0-2)^5}+$$
$$\frac{8d_1'}{3}\Big)H(1,c_2(\alpha_0);y_0)+\Big(\frac{160d_1}{3(y_0-2)^2}+\frac{320d_1}{3(y_0-2)^3}+\frac{80d_1}{(y_0-2)^4}+\frac{64d_1}{3(y_0-2)^5}-\frac{8d_1'}{3}-\frac{160}{3(y_0-2)^2}-\frac{320}{3(y_0-2)^3}-$$
$$\frac{80}{(y_0-2)^4}-\frac{64}{3(y_0-2)^5}+\frac{26}{3}\Big)H(2,0;y_0)+\Big(-\frac{160d_1}{3(y_0-2)^2}-\frac{320d_1}{3(y_0-2)^3}-\frac{80d_1}{(y_0-2)^4}-\frac{64d_1}{3(y_0-2)^5}+\frac{8d_1'}{3}+\frac{160}{3(y_0-2)^2}+$$
$$\frac{320}{3(y_0-2)^3}+\frac{80}{(y_0-2)^4}+\frac{64}{3(y_0-2)^5}-\frac{26}{3}\Big)H(2,c_2(\alpha_0);y_0)+\Big(\frac{4\alpha_0}{3}-\frac{4}{3(y_0-1)}-\frac{4}{3}\Big)H(c_1(\alpha_0),0;y_0)+$$
$$\Big(\frac{2\alpha_0d_1'}{3}-\frac{2d_1'}{3(y_0-1)}-\frac{2d_1'}{3}\Big)H(c_1(\alpha_0),1;y_0)+\Big(\frac{2\alpha_0}{3}-\frac{2}{3(y_0-1)}-\frac{2}{3}\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\Big(\alpha_0^4+\frac{4\alpha_0^3}{3}-$$
$$2\alpha_0^2-4\alpha_0-\frac{160}{3(y_0-2)^2}-\frac{320}{3(y_0-2)^3}-\frac{80}{(y_0-2)^4}-\frac{64}{3(y_0-2)^5}+\frac{11}{3}\Big)H(c_2(\alpha_0),0;y_0)+\Big(\frac{d_1'\alpha_0^4}{2}+\frac{2d_1'\alpha_0^3}{3}-$$
$$d_1'\alpha_0^2-2d_1'\alpha_0+\frac{11d_1'}{6}-\frac{80d_1'}{3(y_0-2)^2}-\frac{160d_1'}{3(y_0-2)^3}-\frac{40d_1'}{(y_0-2)^4}-\frac{32d_1'}{3(y_0-2)^5}\Big)H(c_2(\alpha_0),1;y_0)+\Big(\frac{\alpha_0^4}{2}+\frac{2\alpha_0^3}{3}-$$
$$\alpha_0^2-2\alpha_0-\frac{80}{3(y_0-2)^2}-\frac{160}{3(y_0-2)^3}-\frac{40}{(y_0-2)^4}-\frac{32}{3(y_0-2)^5}+\frac{11}{6}\Big)H(c_2(\alpha_0),c_1(\alpha_0);y_0)-\frac{1}{6}H(0,0,0;Y)-$$
$$\frac{32}{3}H(0,0,0;y_0)-\frac{8}{3}d_1'H(0,0,1;y_0)+\frac{8}{3}H(0,0,c_1(\alpha_0);y_0)-\frac{1}{6}H(0,1,0;Y)+\Big(\frac{4d_1}{3}-\frac{8d_1'}{3}-$$
$$\frac{4}{3}\Big)H(0,1,0;y_0)-\frac{2}{3}d_1'^2H(0,1,1;y_0)+\Big(-\frac{4d_1}{3}+\frac{2d_1'}{3}+\frac{4}{3}\Big)H(0,1,c_1(\alpha_0);y_0)+\frac{4}{3}H(0,c_1(\alpha_0),0;y_0)+$$

$$\tfrac{2}{3}d_1' \ H(0,c_1(\alpha_0),1;y_0)+\tfrac{2}{3}\ H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\tfrac{1}{6}H(1,0,0;Y)-4\ H(1,0,0;y_0)-$$
$$\tfrac{2}{3}d_1'H(1,0,1;y_0)+2\ H(1,0,c_1(\alpha_0);y_0)-\tfrac{1}{6}H(1,1,0;Y)+\left(\tfrac{4\ d_1}{3}-\tfrac{2d_1'}{3}-\tfrac{2}{3}\right)H(1,1,0;y_0)+\Big(-$$
$$\tfrac{4\ d_1}{3}+\tfrac{2d_1'}{3}+\tfrac{2}{3}\Big)\ H(1,1,c_1(\alpha_0);y_0)+\tfrac{4}{3}H(1,c_1(\alpha_0),0;y_0)+\tfrac{2}{3}d_1'\ H(1,c_1(\alpha_0),1;y_0)+$$
$$\tfrac{2}{3}H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+H(0;y_0)\ \Big(\tfrac{y_0^3\alpha_0^4}{9}-\tfrac{y_0^2\alpha_0^4}{6}+\tfrac{2y_0\ \alpha_0^4}{3}-\tfrac{\alpha_0^4}{3(y_0-2)}-\tfrac{\alpha_0^4}{6}-\tfrac{16y_0^3\ \alpha_0^3}{27}+\tfrac{4y_0^2\alpha_0^3}{3}-\tfrac{16y_0\alpha_0^3}{9}-$$
$$\tfrac{2\ \alpha_0^3}{y_0-2}-\tfrac{8\alpha_0^3}{9(y_0-2)^2}-\tfrac{7\alpha_0^3}{9}+\tfrac{4\ y_0^3\alpha_0^2}{3}-4y_0^2\alpha_0^2+\tfrac{10y_0\alpha_0^2}{3}-\tfrac{16\ \alpha_0^2}{3(y_0-2)}-\tfrac{22\alpha_0^2}{3(y_0-2)^2}-\tfrac{8\alpha_0^2}{3\ (y_0-2)^3}-\tfrac{7\alpha_0^2}{6}-\tfrac{16y_0^3\alpha_0}{9}+\tfrac{20y_0^2\ \alpha_0}{3}-$$
$$8y_0\alpha_0-\tfrac{26\alpha_0}{3(y_0-2)}-\tfrac{36\ \alpha_0}{(y_0-2)^2}-\tfrac{104\alpha_0}{3(y_0-2)^3}-\tfrac{32\alpha_0}{3\ (y_0-2)^4}+\alpha_0+\tfrac{2d_1'y_0^3}{9}-\tfrac{139y_0^3}{54}-\tfrac{7\ d_1'y_0^2}{6}+\tfrac{457y_0^2}{36}-\tfrac{41\ d_1}{36}-\tfrac{d_1'}{18}+$$
$$\tfrac{11d_1'y_0}{3}-33y_0+\left(\tfrac{4\ y_0^3}{9}-2y_0^2+4y_0-\tfrac{4}{3(y_0-1)}-\tfrac{160}{3\ (y_0-2)^2}-\tfrac{320}{3(y_0-2)^3}-\tfrac{80}{(y_0-2)^4}-\tfrac{64}{3(\ y_0-2)^5}+3\right)H(0;\alpha_0)+$$
$$\tfrac{2}{3}y_0^3H(0;Y)-3y_0^2H(0;Y)+6\ y_0H(0;Y)+\tfrac{2H(0;Y)}{3(y_0-1)}+\tfrac{80H(0;Y)}{3\ (y_0-2)^2}+\tfrac{160H(0;Y)}{3(y_0-2)^3}+\tfrac{40\ H(0;Y)}{(y_0-2)^4}+\tfrac{32H(0;Y)}{3(y_0-2)^5}+$$
$$\tfrac{5}{18}H(0;Y)-\ \tfrac{2}{3}H(0,0;Y)-\tfrac{2}{3}H(1,0;Y)-\tfrac{8d_1'}{3\ (y_0-2)}+\tfrac{20}{3(y_0-2)}+\tfrac{4d_1}{3(y_0-1)}-\tfrac{2d_1'}{3\ (y_0-1)}-\tfrac{7}{2(y_0-1)}+\tfrac{16d_1}{(y_0-2)^2}-$$
$$\tfrac{12\ d_1'}{(y_0-2)^2}-\tfrac{88}{(y_0-2)^2}+\tfrac{128d_1}{9\ (y_0-2)^3}-\tfrac{88d_1'}{9(y_0-2)^3}-\tfrac{168}{(y_0-2)^3}+\tfrac{4\ d_1}{(y_0-2)^4}-\tfrac{8d_1'}{3\ (y_0-2)^4}-\tfrac{116}{(y_0-2)^4}-\tfrac{256}{9(y_0-2)^5}-\tfrac{320\ \ln 2}{3(y_0-2)^2}-$$
$$\tfrac{640\ln 2}{3(y_0-2)^3}-\tfrac{160\ln\ 2}{(y_0-2)^4}-\tfrac{128\ln 2}{3(y_0-2)^5}+\tfrac{26\ln 2}{3}-\tfrac{\pi^2}{9}+\tfrac{361}{108}\Big)+H(2;y_0)\Big(-\tfrac{160\ \ln 2\, d_1}{3(y_0-2)^2}-\tfrac{320\ln 2\, d_1}{3\ (y_0-2)^3}-\tfrac{80\ln 2\, d_1}{(y_0-2)^4}-$$
$$\tfrac{64\ln 2\, d_1}{3\ (y_0-2)^5}+\Big(-\tfrac{160d_1}{3(y_0-2)^2}-\tfrac{320d_1}{3\ (y_0-2)^3}-\tfrac{80d_1}{(y_0-2)^4}-\tfrac{64d_1}{3\ (y_0-2)^5}+\tfrac{8d_1'}{3}+\tfrac{160}{3(y_0-2)^2}+\tfrac{320}{3\ (y_0-2)^3}+\tfrac{80}{(y_0-2)^4}+\tfrac{64}{3\ (y_0-2)^5}-$$
$$\tfrac{26}{3}\Big)H(0;\alpha_0)+\tfrac{8}{3}d_1'\ln 2\ +\tfrac{160\ln 2}{3(y_0-2)^2}+\tfrac{320\ln 2}{3\ (y_0-2)^3}+\tfrac{80\ln 2}{(y_0-2)^4}+\tfrac{64\ln 2}{3\ (y_0-2)^5}-\tfrac{26\ln 2}{3}\Big)+H(1;y_0)\Big(\tfrac{1}{18}d_1'\ y_0^3\alpha_0^4-$$
$$\tfrac{1}{12}d_1'y_0^2\alpha_0^4-\tfrac{17d_1'\ \alpha_0^4}{36}+\tfrac{1}{3}d_1'y_0\alpha_0^4-\tfrac{d_1'\alpha_0^4}{6\ (y_0-2)}-\tfrac{8}{27}d_1'y_0^3\alpha_0^3+\tfrac{2}{3}d_1'y_0^2\ \alpha_0^3-\tfrac{d_1'\alpha_0^3}{27}-\tfrac{8}{9}d_1'y_0\alpha_0^3-\tfrac{d_1'\ \alpha_0^3}{y_0-2}-\tfrac{4d_1'\alpha_0^3}{9(y_0-2)^2}+$$
$$\tfrac{2}{3}d_1'y_0^3\ \alpha_0^2-2d_1'y_0^2\alpha_0^2-\tfrac{2d_1'\alpha_0^2}{3}+\tfrac{5}{3}d_1'y_0\ \alpha_0^2-\tfrac{8d_1'\alpha_0^2}{3(y_0-2)}-\tfrac{11d_1'\alpha_0^2}{3\ (y_0-2)^2}-\tfrac{4d_1'\alpha_0^2}{3(y_0-2)^3}-\tfrac{8}{9}d_1'y_0^3\ \alpha_0+\tfrac{10}{3}d_1'y_0^2\alpha_0+\tfrac{23d_1'\alpha_0}{9}-$$
$$4d_1'y_0\alpha_0-\ \tfrac{13d_1'\alpha_0}{3(y_0-2)}-\tfrac{18d_1'\alpha_0}{(y_0-2)^2}-\tfrac{52\ d_1'\alpha_0}{3(y_0-2)^3}-\tfrac{16d_1'\alpha_0}{3(y_0-2)^4}+\tfrac{2d_1'^2\ y_0^3}{27}-\tfrac{19d_1'y_0^3}{27}-\tfrac{49d_1'^2}{54}-\tfrac{7\ d_1'^2y_0^2}{18}+\tfrac{11d_1'y_0^2}{3}+\tfrac{199\ d_1'}{27}+$$
$$\tfrac{11d_1'^2y_0}{9}-\tfrac{31d_1'y_0}{3}+H(0;\alpha_0)\ \Big(\tfrac{2d_1'y_0^3}{9}-\tfrac{2y_0^3}{9}-d_1'y_0^2+y_0^2+2d_1'\ y_0-2y_0+\tfrac{13d_1'}{9}+\tfrac{2}{3}H(0;Y)+\tfrac{4d_1}{3\ (y_0-1)}-\tfrac{2d_1'}{3(y_0-1)}-$$
$$\tfrac{2}{3(y_0-1)}-\tfrac{80\ d_1'}{3(y_0-2)^2}+\tfrac{80}{3(y_0-2)^2}-\tfrac{160d_1'}{3\ (y_0-2)^3}+\tfrac{160}{3(y_0-2)^3}-\tfrac{40\ d_1'}{(y_0-2)^4}+\tfrac{40}{(y_0-2)^4}-\tfrac{32d_1'}{3\ (y_0-2)^5}+\tfrac{32}{3(y_0-2)^5}-\tfrac{107}{18}\Big)+$$
$$\tfrac{2}{9}\ d_1'y_0^3H(0;Y)-d_1'y_0^2H(0;Y)-\tfrac{11}{9}d_1'H(0;Y)+2d_1'\ y_0H(0;Y)+\tfrac{4}{3}H(0,0;\alpha_0)+\tfrac{4}{3}d_1\ H(0,1;\alpha_0)+$$
$$\tfrac{8}{3}d_1'\ln 2-\tfrac{80d_1'\ln 2}{3\ (y_0-2)^2}-\tfrac{160d_1'\ln 2}{3(y_0-2)^3}-\tfrac{40d_1'\ln\ 2}{(y_0-2)^4}-\tfrac{32d_1'\ln 2}{3(y_0-2)^5}-\tfrac{\pi\ ^2}{9}\Big)+\tfrac{\pi^2}{9(y_0-1)}+\tfrac{20\pi^2}{9\ (y_0-2)^2}+\tfrac{40\pi^2}{9(y_0-2)^3}+\tfrac{10\pi^2}{3\ (y_0-2)^4}+$$
$$\tfrac{8\pi^2}{9(y_0-2)^5}-\zeta_3+\tfrac{80\ln^2 2}{3(y_0-2)^2}+\tfrac{160\ln^2 2}{3(y_0-2)^3}+\tfrac{40\ln^2 2}{(y_0-2)^4}+\tfrac{32\ln^2 2}{3(y_0-2)^5}-\tfrac{13\ln^2 2}{6}+\tfrac{89}{36}d_1\ln 2-\tfrac{11}{18}d_1'\ln 2-\tfrac{80\ H(0;Y)\ln 2}{3(y_0-2)^2}-$$
$$\tfrac{160H(0;Y)\ln 2}{3\ (y_0-2)^3}-\tfrac{40H(0;Y)\ln 2}{(y_0-2)^4}-\tfrac{32H(0;Y)\ln 2}{3(y_0-2)^5}+\tfrac{13}{6}H(0;Y)\ln 2+\tfrac{8d_1'\ln 2}{3(y_0-2)}-\tfrac{52\ln 2}{3(y_0-2)}-\tfrac{16d_1\ln 2}{(y_0-2)^2}+\tfrac{12d_1'\ln 2}{(y_0-2)^2}+$$
$$\tfrac{460\ln 2}{9\ (y_0-2)^2}-\tfrac{128d_1\ln 2}{9(y_0-2)^3}+\tfrac{88d_1'\ln 2}{9(y_0-2)^3}+\tfrac{400\ln 2}{3(y_0-2)^3}-\tfrac{4d_1\ln 2}{(y_0-2)^4}+\tfrac{8d_1'\ln 2}{3(y_0-2)^4}+\tfrac{316\ln 2}{3(y_0-2)^4}+\tfrac{256\ln 2}{9(y_0-2)^5}-\tfrac{377\ln 2}{36}+\tfrac{\pi^2}{216}+\tfrac{160}{81}.$$

F.4 The $\mathcal{J}{*}\mathcal{I}$ integral for $k=-1$

The ε expansion for this integral reads

$$\mathcal{J\!I}(Y,\epsilon;y_0,d_0',\alpha_0,d_0;-1)=\frac{1}{\varepsilon^4}(j{*}i)_{-4}^{(-1)}+\frac{1}{\varepsilon^3}(j{*}i)_{-3}^{(-1)}+\frac{1}{\varepsilon^2}(j{*}i)_{-2}^{(-1)}+\frac{1}{\varepsilon}(j{*}i)_{-1}^{(-1)}+(j{*}i)_{0}^{(-1)}+\mathcal{O}(\varepsilon)\,, \tag{F.4}$$

where

$$(j*i)_{-4}^{(-1)}=-\tfrac{1}{4},$$

$$(j*i)_{-3}^{(-1)}=-\tfrac{y_0^3}{3}+\tfrac{3y_0^2}{2}-3y_0+\tfrac{1}{4}H(0;Y)+H(0;y_0),$$

$$(j*i)_{-2}^{(-1)}=\tfrac{d_1'y_0^3}{9}+\tfrac{1}{3}H(0;Y)y_0^3-\tfrac{4\ y_0^3}{9}-\tfrac{7d_1'y_0^2}{12}-\tfrac{3}{2}H(0;Y)y_0^2+3\ y_0^2+\tfrac{11d_1'y_0}{6}+3H(0;Y)y_0-$$
$$12y_0+\left(\tfrac{4\ y_0^3}{3}-6y_0^2+12y_0-H(0;Y)\right)H(0;y_0)+\left(\tfrac{d_1'\ y_0^3}{3}-\tfrac{3d_1'y_0^2}{2}+3d_1'y_0-\tfrac{11d_1'}{6}\right)\ H(1;y_0)-$$
$$\tfrac{1}{4}H(0,0;Y)-4H(0,0;y_0)-d_1'\ H(0,1;y_0)-\tfrac{1}{4}H(1,0;Y)-\tfrac{\pi^2}{24},$$

$$(j*i)_{-1}^{(-1)} = \frac{y_0^3\alpha_0^4}{18} - \frac{5y_0^2\alpha_0^4}{12} + \frac{5y_0\ \alpha_0^4}{3} - \frac{13y_0^3\alpha_0^3}{54} + \frac{17y_0^2\alpha_0^3}{9} - \frac{80\ y_0\alpha_0^3}{9} + \frac{11y_0^3\alpha_0^2}{36} - \frac{109y_0^2\ \alpha_0^2}{36} + \frac{158y_0\alpha_0^2}{9} +$$
$$\frac{7y_0^3\alpha_0}{18} + \frac{7\ y_0^2\alpha_0}{18} - \frac{43y_0\alpha_0}{3} - \frac{d_1'^2y_0^3}{27} + \frac{8\ d_1'y_0^3}{27} + \frac{\pi^2y_0^3}{18} - \frac{14y_0^3}{27} + \frac{17\ d_1'^2y_0^2}{72} - \frac{22d_1'y_0^2}{9} - \frac{\pi^2\ y_0^2}{4} + \frac{21y_0^2}{4} - \frac{49d_1'^2y_0}{36} +$$
$$\frac{151d_1'\ y_0}{9} + \frac{\pi^2y_0}{2} - 42y_0 + \Big(-\frac{7y_0^3}{6} + \frac{13\ y_0^2}{3} - \frac{11y_0}{2} + \frac{13}{6(y_0-1)} + \frac{13}{6}\Big)\ H(0;\alpha_0) - \frac{1}{9}d_1'y_0^3H(0;Y) + \frac{4}{9}y_0^3\ H(0;Y) +$$
$$\frac{7}{12}d_1'y_0^2H(0;Y) - 3y_0^2H(0;Y) - \frac{11}{6}\ d_1'y_0H(0;Y) + 12y_0H(0;Y) + \frac{1}{24}\pi^2H(0;Y) + \frac{1}{24}\ \pi^2H(1;Y) + \Big(-$$
$$\frac{1}{9}d_1'^2y_0^3 + \frac{4d_1'\ y_0^3}{9} - \frac{1}{3}d_1'H(0;Y)y_0^3 + \frac{7d_1'^2y_0^2}{12} - 3\ d_1'y_0^2 + \frac{3}{2}d_1'H(0;Y)y_0^2 - \frac{11d_1'^2y_0}{6} + 12\ d_1'y_0 - 3d_1'H(0;Y)y_0 +$$
$$\frac{49d_1'^2}{36} - \frac{85\ d_1'}{9} + \Big(\frac{2y_0^3}{3} - 3y_0^2 + 6\ y_0 + \frac{2}{y_0-1} - \frac{19}{3}\Big)H(0;\alpha_0) + \frac{11}{6}d_1'\ H(0;Y) + \frac{\pi^2}{3}\Big)H(1;y_0) + \Big(-\frac{1}{6}y_0^3\ \alpha_0^4 +$$
$$y_0^2\alpha_0^4 - \frac{5y_0\alpha_0^4}{2} + \frac{5\alpha_0^4}{3} + \frac{8\ y_0^3\alpha_0^3}{9} - 5y_0^2\alpha_0^3 + \frac{38y_0\alpha_0^3}{3} - \frac{68\ \alpha_0^3}{9} - 2y_0^3\alpha_0^2 + \frac{21y_0^2\alpha_0^2}{2} - 26y_0\ \alpha_0^2 + \frac{38\alpha_0^2}{3} + \frac{8y_0^3\alpha_0}{3} -$$
$$13y_0^2\alpha_0 + 30y_0\ \alpha_0 - \frac{41\alpha_0}{3} - \frac{25y_0^3}{18} + \frac{35y_0^2}{6} - \frac{23\ y_0}{2} + \frac{13}{6(y_0-1)} + \frac{13}{6}\Big)\ H(c_1(\alpha_0);y_0) - \frac{1}{3}y_0^3H(0,0;Y) +$$
$$\frac{3}{2}y_0^2\ H(0,0;Y) - 3y_0H(0,0;Y) + \Big(-\frac{16y_0^3}{3} + 24y_0^2 - 48y_0 + 4\ H(0;Y)\Big)H(0,0;y_0) + \Big(-\frac{4d_1'y_0^3}{3} +$$
$$6d_1'y_0^2 - 12\ d_1'y_0 - 4H(0;\alpha_0) + d_1'H(0;Y)\Big)H(0,1;y_0) + \Big(\alpha_0^4 - \frac{16\ \alpha_0^3}{3} + 12\alpha_0^2 - 16\alpha_0 + \frac{2y_0^3}{3} - 3y_0^2 + 6\ y_0 +$$
$$\frac{2}{y_0-1} + 2\Big)H(0,c_1(\alpha_0);y_0) - \frac{1}{3}y_0^3\ H(1,0;Y) + \frac{3}{2}y_0^2H(1,0;Y) - 3y_0H(1,0;Y) + H(0;y_0)\ \Big(-\frac{4d_1'y_0^3}{9} -$$
$$\frac{4}{3}H(0;Y)y_0^3 + \frac{53\ y_0^3}{18} + \frac{7d_1'y_0^2}{3} + 6H(0;Y)y_0^2 - \frac{49\ y_0^2}{3} - \frac{22d_1'y_0}{3} - 12H(0;Y)y_0 + \frac{107\ y_0}{2} + H(0,0;Y) +$$
$$H(1,0;Y) - \frac{13}{6(y_0-1)} + \frac{\pi^{\ 2}}{6} - \frac{13}{6}\Big) + \Big(-\frac{4d_1'y_0^3}{3} - \frac{2\ y_0^3}{3} + 6d_1'y_0^2 + 3y_0^2 - 12d_1'y_0 - 6y_0 + \frac{22\ d_1'}{3} - \frac{2}{y_0-1} +$$
$$\frac{19}{3}\Big)\ H(1,0;y_0) + \Big(-\frac{1}{3}d_1'^2y_0^3 + \frac{3d_1'^2y_0^2}{2} - 3\ d_1'^2y_0 + \frac{11d_1'^2}{6} - 2H(0;\alpha_0)\Big)\ H(1,1;y_0) + \Big(\frac{2y_0^3}{3} - 3y_0^2 + 6\ y_0 + \frac{2}{y_0-1} -$$
$$\frac{19}{3}\Big)H(1,c_1(\alpha_0);y_0) + \Big(2\ \alpha_0 - \frac{2}{y_0-1} - 2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0) + \frac{1}{4}\ H(0,0,0;Y) + 16H(0,0,0;y_0) +$$
$$4d_1'H(0,0,1;y_0) - 4H(0,0,c_1(\alpha_0);y_0) + \frac{1}{4}H(0,1,0;Y) + (4d_1' + 4)H(0,1,0;y_0) + d_1'^2H(0,1,1;y_0) -$$
$$4\ H(0,1,c_1(\alpha_0);y_0) + 2H(0,c_1(\alpha_0),c_1(\alpha_0);y_0) + \frac{1}{4}\ H(1,0,0;Y) - 2H(1,0,c_1(\alpha_0);y_0) +$$
$$\frac{1}{4}H(1,1,0;Y) + 2\ H(1,1,0;y_0) - 2H(1,1,c_1(\alpha_0);y_0) + 2\ H(1,c_1(\alpha_0),c_1(\alpha_0);y_0) - \frac{\pi^2}{3(y_0-1)} + \frac{3\ \zeta_3}{2} - \frac{\pi^2}{3},$$

$$(j*i)_0^{(-1)} =$$
$$-\frac{1}{36}d_1y_0^3\alpha_0^4 - \frac{1}{27}d_1'y_0^3\alpha_0^4 + \frac{13\ y_0^3\alpha_0^4}{108} + \frac{5}{24}d_1y_0^2\alpha_0^4 + \frac{13}{36}d_1'\ y_0^2\alpha_0^4 - \frac{7y_0^2\alpha_0^4}{6} - \frac{5}{6}d_1y_0\ \alpha_0^4 - \frac{47}{18}d_1'y_0\alpha_0^4 + \frac{97y_0\ \alpha_0^4}{12} -$$
$$\frac{1}{18}y_0^3H(0;Y)\alpha_0^4 + \frac{5}{12}y_0^2H(0;Y)\ \alpha_0^4 - \frac{5}{3}y_0H(0;Y)\alpha_0^4 + \frac{31}{324}d_1y_0^3\ \alpha_0^3 + \frac{29}{162}d_1'y_0^3\alpha_0^3 - \frac{185y_0^3\ \alpha_0^3}{324} - \frac{91}{108}d_1y_0^2\alpha_0^3 -$$
$$\frac{187}{108}d_1'y_0^2\ \alpha_0^3 + \frac{631y_0^2\alpha_0^3}{108} + \frac{245}{54}d_1y_0\ \alpha_0^3 + \frac{1549}{108}d_1'y_0\alpha_0^3 - \frac{5095y_0\ \alpha_0^3}{108} + \frac{13}{54}y_0^3H(0;Y)\alpha_0^3 - \frac{17}{9}y_0^2\ H(0;Y)\alpha_0^3 +$$
$$\frac{80}{9}y_0H(0;Y)\alpha_0^3 + \frac{17}{216}d_1y_0^3\ \alpha_0^2 - \frac{35}{108}d_1'y_0^3\alpha_0^2 + \frac{179y_0^3\ \alpha_0^2}{216} + \frac{17}{27}d_1y_0^2\alpha_0^2 + \frac{707}{216}d_1'y_0^2\ \alpha_0^2 - \frac{589y_0^2\alpha_0^2}{54} - \frac{895}{108}d_1y_0\ \alpha_0^2 -$$
$$\frac{809}{27}d_1'y_0\alpha_0^2 + \frac{2836y_0\ \alpha_0^2}{27} - \frac{11}{36}y_0^3H(0;Y)\alpha_0^2 + \frac{109}{36}y_0^2\ H(0;Y)\alpha_0^2 - \frac{158}{9}y_0H(0;Y)\alpha_0^2 - \frac{205}{108}d_1y_0^3\ \alpha_0 +$$
$$\frac{1}{6}d_1'y_0^3\alpha_0 + \frac{95y_0^3\ \alpha_0}{54} + \frac{659}{108}d_1y_0^2\alpha_0 - \frac{74}{27}d_1'y_0^2\ \alpha_0 + \frac{187y_0^2\alpha_0}{108} + \frac{d_1y_0\alpha_0}{36} + \frac{278d_1'\ y_0\alpha_0}{9} - \frac{219y_0\alpha_0}{2} - \frac{7}{18}y_0^3H(0;Y)\ \alpha_0 -$$
$$\frac{7}{18}y_0^2H(0;Y)\alpha_0 + \frac{43}{3}y_0H(0;Y)\ \alpha_0 + \frac{d_1'^3y_0^3}{81} - \frac{4d_1'^2y_0^3}{27} + \frac{14d_1'\ y_0^3}{27} - \frac{1}{54}d_1'\pi^2y_0^3 + \frac{29\pi^2\ y_0^3}{108} - \frac{46y_0^3}{81} - \frac{43d_1'^3y_0^2}{432} +$$
$$\frac{167\ d_1'^2y_0^2}{108} - \frac{1435d_1'y_0^2}{216} + \frac{7}{72}d_1'\pi^{\ 2}y_0^2 - \frac{11\pi^2y_0^2}{9} + \frac{69y_0^2}{8} + \frac{251\ d_1'^3y_0}{216} - \frac{542d_1'^2y_0}{27} + \frac{10367d_1'\ y_0}{108} - \frac{11}{36}d_1'\pi^2y_0 + \frac{35\pi^2y_0}{12} -$$
$$138\ y_0 + \frac{1}{27}d_1'^2y_0^3H(0;Y) - \frac{8}{27}d_1'y_0^3\ H(0;Y) - \frac{1}{18}\pi^2y_0^3H(0;Y) + \frac{14}{27}y_0^3\ H(0;Y) - \frac{17}{72}d_1'^2y_0^2H(0;Y) +$$
$$\frac{22}{9}d_1'y_0^2\ H(0;Y) + \frac{1}{4}\pi^2y_0^2H(0;Y) - \frac{21}{4}y_0^2\ H(0;Y) + \frac{49}{36}d_1'^2y_0H(0;Y) - \frac{151}{9}d_1'y_0H(0;Y) -$$
$$\frac{1}{2}\pi^2y_0H(0;Y) + 42y_0H(0;Y) + \frac{\pi^2H(0;Y)}{3\ (y_0-1)} + \frac{1}{3}\pi^2H(0;Y) + H(0;\alpha_0)\Big(-\frac{1}{9}y_0^3\ \alpha_0^4 + \frac{5y_0^2\alpha_0^4}{6} - \frac{10y_0\alpha_0^4}{3} + \frac{13y_0^3\ \alpha_0^3}{27} -$$
$$\frac{34y_0^2\alpha_0^3}{9} + \frac{160y_0\alpha_0^3}{9} - \frac{11\ y_0^3\alpha_0^2}{18} + \frac{109y_0^2\alpha_0^2}{18} - \frac{316y_0\ \alpha_0^2}{9} - \frac{7y_0^3\alpha_0}{9} - \frac{7y_0^2\alpha_0}{9} + \frac{86y_0\ \alpha_0}{3} + \frac{205d_1y_0^3}{108} + \frac{17d_1'y_0^3}{54} - \frac{35\ y_0^3}{9} - \frac{22d_1y_0^2}{3} -$$
$$\frac{10d_1'y_0^2}{9} + \frac{649\ y_0^2}{36} - \frac{217d_1}{36} + \frac{d_1'}{6} + \frac{469d_1\ y_0}{36} - \frac{7d_1'y_0}{18} - \frac{299y_0}{9} + \frac{7}{6}y_0^3\ H(0;Y) - \frac{13}{3}y_0^2H(0;Y) + \frac{11}{2}y_0H(0;Y) -$$
$$\frac{13\ H(0;Y)}{6(y_0-1)} - \frac{13}{6}H(0;Y) - \frac{217d_1}{36\ (y_0-1)} + \frac{d_1'}{6(y_0-1)} + \frac{149}{18(y_0-1)} + \frac{149}{18}\ \Big) + \Big(-\frac{1}{9}d_1y_0^3\alpha_0^4 + \frac{5}{6}d_1y_0^2\ \alpha_0^4 - \frac{10}{3}d_1y_0\alpha_0^4 +$$
$$\frac{13}{27}d_1y_0^3\ \alpha_0^3 - \frac{34}{9}d_1y_0^2\alpha_0^3 + \frac{160}{9}d_1y_0\ \alpha_0^3 - \frac{11}{18}d_1y_0^3\alpha_0^2 + \frac{109}{18}d_1y_0^2\ \alpha_0^2 - \frac{316}{9}d_1y_0\alpha_0^2 - \frac{7}{9}d_1y_0^3\ \alpha_0 - \frac{7}{9}d_1y_0^2\alpha_0 +$$
$$\frac{86d_1y_0\alpha_0}{3} + \frac{55d_1\ y_0^3}{54} - \frac{7d_1y_0^2}{3} - 8d_1y_0\Big)H(1;\alpha_0) + \frac{1}{18}\ \pi^2y_0^3H(1;Y) - \frac{1}{4}\pi^2y_0^2H(1;Y) + \frac{1}{2}\pi^{\ 2}y_0H(1;Y) +$$

$$\Big(\frac{1}{12}d_1 y_0^3\alpha_0^4+\frac{1}{18}d'_1 y_0^3\alpha_0^4-\frac{y_0^3\alpha_0^4}{4}-\frac{1}{2}d_1y_0^2\alpha_0^4-\frac{5}{12}d'_1y_0^2\alpha_0^4+\frac{7y_0^2\alpha_0^4}{4}-\frac{5d_1\alpha_0^4}{6}-\frac{47d'_1\alpha_0^4}{36}+\frac{5}{4}d_1y_0\alpha_0^4+\frac{5}{3}d'_1y_0\alpha_0^4-$$
$$\frac{25y_0\alpha_0^4}{4}+\frac16 y_0^3H(0;Y)\alpha_0^4-y_0^2H(0;Y)\alpha_0^4+\frac52 y_0H(0;Y)\alpha_0^4-\frac53H(0;Y)\alpha_0^4+\frac{19\alpha_0^4}{4}-\frac{13}{27}d_1y_0^3\alpha_0^3-\frac{8}{27}d'_1y_0^3\alpha_0^3+$$
$$\frac{77y_0^3\alpha_0^3}{54}+\frac83 d_1y_0^2\alpha_0^3+\frac{37}{18}d'_1y_0^2\alpha_0^3-\frac{29y_0^2\alpha_0^3}{3}+\frac{221d_1\alpha_0^3}{54}+\frac{313d'_1\alpha_0^3}{54}-\frac{61}{9}d_1y_0\alpha_0^3-\frac{77}{9}d'_1y_0\alpha_0^3+\frac{331y_0\alpha_0^3}{9}-$$
$$\frac89 y_0^3H(0;Y)\alpha_0^3+5y_0^2H(0;Y)\alpha_0^3-\frac{38}{3}y_0H(0;Y)\alpha_0^3+\frac{68}{9}H(0;Y)\alpha_0^3-\frac{676\alpha_0^3}{27}+\frac{23}{18}d_1y_0^3\alpha_0^2+\frac23 d'_1y_0^3\alpha_0^2-$$
$$\frac{131y_0^3\alpha_0^2}{36}-\frac{13}{2}d_1y_0^2\alpha_0^2-\frac{17}{4}d'_1y_0^2\alpha_0^2+\frac{283y_0^2\alpha_0^2}{12}-\frac{287d_1\alpha_0^2}{36}-\frac{28d'_1\alpha_0^2}{3}+\frac{95}{6}d_1y_0\alpha_0^2+\frac{35}{2}d'_1y_0\alpha_0^2-\frac{533y_0\alpha_0^2}{6}+$$
$$2y_0^3H(0;Y)\alpha_0^2-\frac{21}{2}y_0^2H(0;Y)\alpha_0^2+26y_0H(0;Y)\alpha_0^2-\frac{38}{3}H(0;Y)\alpha_0^2+\frac{149\alpha_0^2}{3}-\frac{25}{9}d_1y_0^3\alpha_0-\frac89 d'_1y_0^3\alpha_0+$$
$$\frac{121y_0^3\alpha_0}{18}+13d_1y_0^2\alpha_0+\frac{31}{6}d'_1y_0^2\alpha_0-\frac{241y_0^2\alpha_0}{6}+\frac{343d_1\alpha_0}{18}+\frac{47d'_1\alpha_0}{6}-\frac{85d_1y_0\alpha_0}{3}-\frac{59d'_1y_0\alpha_0}{3}+\frac{404y_0\alpha_0}{3}-$$
$$\frac83 y_0^3H(0;Y)\alpha_0+13y_0^2H(0;Y)\alpha_0-30y_0H(0;Y)\alpha_0+\frac{41}{3}H(0;Y)\alpha_0-\frac{143\alpha_0}{2}+\frac{205d_1y_0^3}{108}+\frac{25d'_1y_0^3}{54}-\frac{115y_0^3}{27}-$$
$$\frac{22d_1y_0^2}{3}-\frac{7d'_1y_0^2}{3}+\frac{196y_0^2}{9}-\frac{217d_1}{36}+\frac{d'_1}{6}+\frac{469d_1y_0}{36}+8d'_1y_0-\frac{569y_0}{9}+\Big(\frac{y_0^3\alpha_0^4}{3}-2y_0^2\alpha_0^4+5y_0\alpha_0^4-\frac{10\alpha_0^4}{3}-\frac{16y_0^3\alpha_0^3}{9}+$$
$$10y_0^2\alpha_0^3-\frac{76y_0\alpha_0^3}{3}+\frac{136\alpha_0^3}{9}+4y_0^3\alpha_0^2-21y_0^2\alpha_0^2+52y_0\alpha_0^2-\frac{76\alpha_0^2}{3}-\frac{16y_0^3\alpha_0}{3}+26y_0^2\alpha_0-60y_0\alpha_0+\frac{82\alpha_0}{3}+$$
$$\frac{25y_0^3}{9}-\frac{35y_0^2}{3}+23y_0-\frac{13}{3(y_0-1)}-\frac{13}{3}\Big)H(0;\alpha_0)+\frac{25}{18}y_0^3H(0;Y)-\frac{35}{6}y_0^2H(0;Y)+\frac{23}{2}y_0H(0;Y)-\frac{13H(0;Y)}{6(y_0-1)}-$$
$$\frac{13}{6}H(0;Y)+\Big(\frac13 d_1y_0^3\alpha_0^4-2d_1y_0^2\alpha_0^4-\frac{10d_1\alpha_0^4}{3}+5d_1y_0\alpha_0^4-\frac{16}{9}d_1y_0^3\alpha_0^3+10d_1y_0^2\alpha_0^3+\frac{136d_1\alpha_0^3}{9}-\frac{76}{3}d_1y_0\alpha_0^3+$$
$$4d_1y_0^3\alpha_0^2-21d_1y_0^2\alpha_0^2-\frac{76d_1\alpha_0^2}{3}+52d_1y_0\alpha_0^2-\frac{16}{3}d_1y_0^3\alpha_0+26d_1y_0^2\alpha_0+\frac{82d_1\alpha_0}{3}-60d_1y_0\alpha_0+\frac{25d_1y_0^3}{9}-$$
$$\frac{35d_1y_0^2}{3}-\frac{13d_1}{3}+23d_1y_0-\frac{13d_1}{3(y_0-1)}\Big)H(1;\alpha_0)-\frac{217d_1}{36(y_0-1)}+\frac{d'_1}{6(y_0-1)}+\frac{149}{18(y_0-1)}+\frac{149}{18}\Big)H(c_1(\alpha_0);y_0)+$$
$$\Big(\frac{7y_0^3}{3}-\frac{26y_0^2}{3}+11y_0-\frac{13}{3(y_0-1)}-\frac{13}{3}\Big)H(0,0;\alpha_0)+\frac19 d'_1y_0^3H(0,0;Y)-\frac49 y_0^3H(0,0;Y)-\frac{7}{12}d'_1y_0^2H(0,0;Y)+$$
$$3y_0^2H(0,0;Y)+\frac{11}{6}d'_1y_0H(0,0;Y)-12y_0H(0,0;Y)-\frac{1}{24}\pi^2H(0,0;Y)+\Big(\frac{7d_1y_0^3}{3}-\frac{26d_1y_0^2}{3}+11d_1y_0-$$
$$\frac{13d_1}{3}-\frac{13d_1}{3(y_0-1)}\Big)H(0,1;\alpha_0)-\frac{1}{24}\pi^2H(0,1;Y)+\Big(-\frac{d_1\alpha_0^4}{2}-H(0;Y)\alpha_0^4+\frac{\alpha_0^4}{2}+\frac{26d_1\alpha_0^3}{9}+\frac{16}{3}H(0;Y)\alpha_0^3-$$
$$\frac{38\alpha_0^3}{9}-\frac{23d_1\alpha_0^2}{3}-12H(0;Y)\alpha_0^2+\frac{49\alpha_0^2}{3}+\frac{50d_1\alpha_0}{3}+16H(0;Y)\alpha_0-\frac{142\alpha_0}{3}-\frac{2d'_1y_0^3}{9}+\frac{37y_0^3}{18}+\frac{7d'_1y_0^2}{6}-\frac{31y_0^2}{3}-$$
$$4d_1+2d'_1-\frac{11d'_1y_0}{3}+\frac{59y_0}{2}+\Big(-2\alpha_0^4+\frac{32\alpha_0^3}{3}-24\alpha_0^2+32\alpha_0-\frac{4y_0^3}{3}+6y_0^2-12y_0-\frac{4}{y_0-1}-4\Big)H(0;\alpha_0)-$$
$$\frac23 y_0^3H(0;Y)+3y_0^2H(0;Y)-6y_0H(0;Y)-\frac{2H(0;Y)}{y_0-1}-2H(0;Y)+\Big(-2d_1\alpha_0^4+\frac{32d_1\alpha_0^3}{3}-24d_1\alpha_0^2+32d_1\alpha_0-$$
$$\frac{4d_1y_0^3}{3}+6d_1y_0^2-4d_1-12d_1y_0-\frac{4d_1}{y_0-1}\Big)H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d'_1}{y_0-1}+\frac{11}{6(y_0-1)}+\frac{11}{6}\Big)H(0,c_1(\alpha_0);y_0)+$$
$$H(0,0;y_0)\Big(\frac{16d'_1y_0^3}{9}+\frac{16}{3}H(0;Y)y_0^3-\frac{127y_0^3}{9}-\frac{28d'_1y_0^2}{3}-24H(0;Y)y_0^2+74y_0^2+\frac{88d'_1y_0}{3}+48H(0;Y)y_0-$$
$$225y_0-4H(0,0;Y)-4H(1,0;Y)+\frac{13}{y_0-1}-\frac{2\pi^2}{3}+13\Big)+\frac19 d'_1y_0^3H(1,0;Y)-\frac49 y_0^3H(1,0;Y)-$$
$$\frac{7}{12}d'_1y_0^2H(1,0;Y)+3y_0^2H(1,0;Y)+\frac{11}{6}d'_1y_0H(1,0;Y)-12y_0H(1,0;Y)-\frac{1}{24}\pi^2H(1,0;Y)+$$
$$H(0,1;y_0)\Big(\frac{4d_1'^2y_0^3}{9}-\frac{53d'_1y_0^3}{18}+\frac43 d'_1H(0;Y)y_0^3-\frac{7d_1'^2y_0^2}{3}+\frac{49d'_1y_0^2}{3}-6d'_1H(0;Y)y_0^2+\frac{22d_1'^2y_0}{3}-\frac{107d'_1y_0}{2}+$$
$$12d'_1H(0;Y)y_0+\frac{13d'_1}{6}+H(0;\alpha_0)\Big(\frac{4d_1y_0^3}{3}-\frac{4y_0^3}{3}-6d_1y_0^2+6y_0^2+12d_1y_0-12y_0-\frac{38d_1}{3}+4H(0;Y)+\frac{4d_1}{y_0-1}-$$
$$\frac{4}{y_0-1}-\frac{62}{3}\Big)+8H(0,0;\alpha_0)-d'_1H(0,0;Y)+8d_1H(0,1;\alpha_0)-d'_1H(1,0;Y)+\frac{13d'_1}{6(y_0-1)}+\frac{2d_1\pi^2}{3}-\frac{d'_1\pi^2}{6}\Big)+$$
$$\Big(\frac{4d_1'^2y_0^3}{9}-\frac{49d'_1y_0^3}{18}+\frac43 d'_1H(0;Y)y_0^3+\frac23H(0;Y)y_0^3-\frac{37y_0^3}{18}-\frac{7d_1'^2y_0^2}{3}+\frac{4d_1y_0^2}{3}+\frac{91d'_1y_0^2}{6}-6d'_1H(0;Y)y_0^2-$$
$$3H(0;Y)y_0^2+\frac{35y_0^2}{3}+\frac{22d_1'^2y_0}{3}-\frac{16d_1y_0}{3}-\frac{299d'_1y_0}{6}+12d'_1H(0;Y)y_0+6H(0;Y)y_0-\frac{209y_0}{6}-\frac{49d_1'^2}{9}+\frac{37d_1}{18}+$$
$$\frac{673d'_1}{18}+\Big(-\frac{4y_0^3}{3}+6y_0^2-12y_0-\frac{4}{y_0-1}+\frac{38}{3}\Big)H(0;\alpha_0)-\frac{22}{3}d'_1H(0;Y)+\frac{2H(0;Y)}{y_0-1}-\frac{19}{3}H(0;Y)-\frac{d_1}{3(y_0-1)}+$$
$$\frac{d'_1}{6(y_0-1)}-\frac{37}{6(y_0-1)}-\frac{4\pi^2}{3}+\frac{127}{3}\Big)H(1,0;y_0)-\frac{1}{24}\pi^2H(1,1;Y)+\Big(\frac{y_0^3d_1'^3}{9}-\frac{7y_0^2d_1'^3}{12}+\frac{11y_0d_1'^3}{6}-\frac{49d_1'^3}{36}-$$
$$\frac{4y_0^3d_1'^2}{9}+3y_0^2d_1'^2-12y_0d_1'^2+\frac13 y_0^3H(0;Y)d_1'^2-\frac32 y_0^2H(0;Y)d_1'^2+3y_0H(0;Y)d_1'^2-\frac{11}{6}H(0;Y)d_1'^2+\frac{85d_1'^2}{9}-$$
$$\frac{\pi^2d'_1}{3}+H(0;\alpha_0)\Big(\frac{4d_1y_0^3}{3}-\frac{4d'_1y_0^3}{3}+\frac{2y_0^3}{3}-6d_1y_0^2+6d'_1y_0^2-3y_0^2+12d_1y_0-12d'_1y_0+6y_0-\frac{38d_1}{3}+10d'_1+$$

$2H(0;Y)+\frac{8d_1}{y_0-1}-\frac{4d_1'}{y_0-1}-\frac{2}{y_0-1}-\frac{43}{3}\Big)+4\,H(0,0;\alpha_0)+4d_1H(0,1;\alpha_0)+\frac{2d_1\pi^2}{3}-\frac{\pi^2}{3}\Big)H(1,1;y_0)+$
$\Big(\frac{1}{6}d_1'y_0^3\alpha_0^4-d_1'y_0^2\alpha_0^4-\frac{5d_1'\alpha_0^4}{3}+\frac{5}{2}d_1'y_0\alpha_0^4-\frac{8}{9}d_1'y_0^3\alpha_0^3+5d_1'y_0^2\alpha_0^3+\frac{77d_1'\alpha_0^3}{9}-\frac{38}{3}d_1'y_0\alpha_0^3+2d_1'y_0^3\alpha_0^2-$
$\frac{21}{2}d_1'y_0^2\alpha_0^2-\frac{35d_1'\alpha_0^2}{2}+26d_1'y_0\alpha_0^2-\frac{8}{3}d_1'y_0^3\alpha_0+13d_1'y_0^2\alpha_0+\frac{65d_1'\alpha_0}{3}-30d_1'y_0\alpha_0+\frac{7d_1'y_0^3}{6}+\frac{37y_0^3}{18}-\frac{4d_1y_0^2}{3}-$
$\frac{14d_1'y_0^2}{3}-\frac{35y_0^2}{3}-\frac{37d_1}{18}-\frac{13d_1'}{3}+\frac{16d_1y_0}{3}+\frac{47d_1'y_0}{6}+\frac{209y_0}{6}+\Big(-\frac{4y_0^3}{3}+6y_0^2-12y_0-\frac{4}{y_0-1}+\frac{38}{3}\Big)H(0;\alpha_0)-$
$\frac{2}{3}y_0^3H(0;Y)+3y_0^2H(0;Y)-6y_0H(0;Y)-\frac{2H(0;Y)}{y_0-1}+\frac{19}{3}H(0;Y)+\Big(-\frac{4d_1y_0^3}{3}+6d_1y_0^2-12d_1y_0+\frac{38d_1}{3}-$
$\frac{4d_1}{y_0-1}\Big)H(1;\alpha_0)+\frac{d_1}{3(y_0-1)}-\frac{d_1'}{6(y_0-1)}+\frac{37}{6(y_0-1)}-\frac{127}{3}\Big)H(1,c_1(\alpha_0);y_0)+\Big(\frac{y_0^3\alpha_0^4}{3}-2y_0^2\alpha_0^4+5y_0\alpha_0^4-\frac{10\alpha_0^4}{3}-$
$\frac{16y_0^3\alpha_0^3}{9}+10y_0^2\alpha_0^3-\frac{76y_0\alpha_0^3}{3}+\frac{136\alpha_0^3}{9}+4y_0^3\alpha_0^2-21y_0^2\alpha_0^2+52y_0\alpha_0^2-\frac{76\alpha_0^2}{3}-\frac{16y_0^3\alpha_0}{3}+26y_0^2\alpha_0-60y_0\alpha_0+$
$\frac{82\alpha_0}{3}+\frac{25y_0^3}{9}-\frac{35y_0^2}{3}+23y_0-\frac{13}{3(y_0-1)}-\frac{13}{3}\Big)H(c_1(\alpha_0),0;y_0)+\Big(\frac{1}{6}d_1'y_0^3\alpha_0^4-d_1'y_0^2\alpha_0^4-\frac{5d_1'\alpha_0^4}{3}+\frac{5}{2}d_1'y_0\alpha_0^4-$
$\frac{8}{9}d_1'y_0^3\alpha_0^3+5d_1'y_0^2\alpha_0^3+\frac{68d_1'\alpha_0^3}{9}-\frac{38}{3}d_1'y_0\alpha_0^3+2d_1'y_0^3\alpha_0^2-\frac{21}{2}d_1'y_0^2\alpha_0^2-\frac{38d_1'\alpha_0^2}{3}+26d_1'y_0\alpha_0^2-\frac{8}{3}d_1'y_0^3\alpha_0+$
$13d_1'y_0^2\alpha_0+\frac{41d_1'\alpha_0}{3}-30d_1'y_0\alpha_0+\frac{25d_1'y_0^3}{18}-\frac{35d_1'y_0^2}{6}-\frac{13d_1'}{6}+\frac{23d_1'y_0}{2}-\frac{13d_1'}{6(y_0-1)}\Big)H(c_1(\alpha_0),1;y_0)+\Big(\frac{y_0^3\alpha_0^4}{2}-$
$3y_0^2\alpha_0^4+\frac{15y_0\alpha_0^4}{2}-5\alpha_0^4-\frac{8y_0^3\alpha_0^3}{3}+15y_0^2\alpha_0^3-38y_0\alpha_0^3+\frac{68\alpha_0^3}{3}+6y_0^3\alpha_0^2-\frac{63y_0^2\alpha_0^2}{2}+78y_0\alpha_0^2-38\alpha_0^2-8y_0^3\alpha_0+$
$39y_0^2\alpha_0-4d_1\alpha_0+2d_1'\alpha_0-90y_0\alpha_0-2H(0;Y)\alpha_0+45\alpha_0+\frac{25y_0^3}{6}-\frac{35y_0^2}{2}+4d_1-2d_1'+\frac{69y_0}{2}+\Big(-$
$4\alpha_0+\frac{4}{y_0-1}+4\Big)H(0;\alpha_0)+\frac{2H(0;Y)}{y_0-1}+2H(0;Y)+\Big(-4\alpha_0d_1+\frac{4d_1}{y_0-1}+4d_1\Big)H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-$
$\frac{21}{2(y_0-1)}-\frac{21}{2}\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3H(0,0,0;Y)-\frac{3}{2}y_0^2H(0,0,0;Y)+3y_0H(0,0,0;Y)+$
$\Big(\frac{64y_0^3}{3}-96y_0^2+192y_0-16H(0;Y)\Big)H(0,0,0;y_0)+\Big(\frac{16d_1'y_0^3}{3}-24d_1'y_0^2+48d_1'y_0+(8-8d_1)H(0;\alpha_0)-$
$4d_1'H(0;Y)\Big)H(0,0,1;y_0)+\Big(-\frac{8y_0^3}{3}+12y_0^2-24y_0+8H(0;\alpha_0)+4H(0;Y)+8d_1H(1;\alpha_0)-$
$\frac{8}{y_0-1}-8\Big)H(0,0,c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3H(0,1,0;Y)-\frac{3}{2}y_0^2H(0,1,0;Y)+3y_0H(0,1,0;Y)+\Big(-\frac{4d_1y_0^3}{3}+$
$\frac{16d_1'y_0^3}{3}+\frac{4y_0^3}{3}+6d_1y_0^2-24d_1'y_0^2-6y_0^2-12d_1y_0+48d_1'y_0+12y_0+\frac{38d_1}{3}+8H(0;\alpha_0)-4d_1'H(0;Y)-$
$4H(0;Y)-\frac{4d_1}{y_0-1}+\frac{4}{y_0-1}+\frac{62}{3}\Big)H(0,1,0;y_0)+\Big(\frac{4d_1'^2y_0^3}{3}-6d_1'^2y_0^2+12d_1'^2y_0+(8d_1'-12d_1)H(0;\alpha_0)-$
$d_1'^2H(0;Y)\Big)H(0,1,1;y_0)+\Big(-d_1'\alpha_0^4+\frac{16d_1'\alpha_0^3}{3}-12d_1'\alpha_0^2+16d_1'\alpha_0+\frac{4d_1y_0^3}{3}-\frac{2d_1'y_0^3}{3}-\frac{4y_0^3}{3}-6d_1y_0^2+3d_1'y_0^2+$
$6y_0^2-\frac{38d_1}{3}-2d_1'+12d_1y_0-6d_1'y_0-12y_0+8H(0;\alpha_0)+4H(0;Y)+8d_1H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{4}{y_0-1}-$
$\frac{62}{3}\Big)H(0,1,c_1(\alpha_0);y_0)+\Big(-2\alpha_0^4+\frac{32\alpha_0^3}{3}-24\alpha_0^2+32\alpha_0-\frac{4y_0^3}{3}+6y_0^2-12y_0-\frac{4}{y_0-1}-4\Big)H(0,c_1(\alpha_0),0;y_0)+$
$\Big(-d_1'\alpha_0^4+\frac{16d_1'\alpha_0^3}{3}-12d_1'\alpha_0^2+16d_1'\alpha_0-\frac{2d_1'y_0^3}{3}+3d_1'y_0^2-2d_1'-6d_1'y_0-\frac{2d_1'}{y_0-1}\Big)H(0,c_1(\alpha_0),1;y_0)+$
$\Big(-3\alpha_0^4+16\alpha_0^3-36\alpha_0^2+48\alpha_0-2y_0^3+9y_0^2-18y_0-4H(0;\alpha_0)-2H(0;Y)-4d_1H(1;\alpha_0)+\frac{2}{y_0-1}+$
$2\Big)H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+\frac{1}{3}y_0^3H(1,0,0;Y)-\frac{3}{2}y_0^2H(1,0,0;Y)+3y_0H(1,0,0;Y)+\Big(\frac{16d_1'y_0^3}{3}+4y_0^3-$
$24d_1'y_0^2-18y_0^2+48d_1'y_0+36y_0-\frac{88d_1'}{3}+\frac{12}{y_0-1}-38\Big)H(1,0,0;y_0)+\Big(\frac{4d_1'^2y_0^3}{3}+\frac{2d_1'y_0^3}{3}-6d_1'^2y_0^2-3d_1'y_0^2+$
$12d_1'^2y_0+6d_1'y_0-\frac{22d_1'^2}{3}-\frac{19d_1'}{3}+(4-4d_1)H(0;\alpha_0)+\frac{2d_1'}{y_0-1}\Big)H(1,0,1;y_0)+\Big(-\frac{2d_1'y_0^3}{3}-\frac{2y_0^3}{3}+3d_1'y_0^2+3y_0^2-$
$6d_1'y_0-6y_0+\frac{11d_1'}{3}+4H(0;\alpha_0)+2H(0;Y)+4d_1H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{6}{y_0-1}-\frac{5}{3}\Big)H(1,0,c_1(\alpha_0);y_0)+$
$\frac{1}{3}y_0^3H(1,1,0;Y)-\frac{3}{2}y_0^2H(1,1,0;Y)+3y_0H(1,1,0;Y)+\Big(\frac{4d_1'^2y_0^3}{3}-\frac{4d_1y_0^3}{3}+\frac{4d_1'y_0^3}{3}-\frac{2y_0^3}{3}-6d_1'^2y_0^2+$
$6d_1y_0^2-6d_1'y_0^2+3y_0^2+12d_1'^2y_0-12d_1y_0+12d_1'y_0-6y_0-\frac{22d_1'^2}{3}+\frac{38d_1}{3}-10d_1'+4H(0;\alpha_0)-$
$2H(0;Y)-\frac{8d_1}{y_0-1}+\frac{4d_1'}{y_0-1}+\frac{2}{y_0-1}+\frac{43}{3}\Big)H(1,1,0;y_0)+\Big(\frac{y_0^3d_1'^3}{3}-\frac{3y_0^2d_1'^3}{2}+3y_0d_1'^3-\frac{11d_1'^3}{6}+(-8d_1+4d_1'+$
$2)H(0;\alpha_0)\Big)H(1,1,1;y_0)+\Big(\frac{4d_1y_0^3}{3}-\frac{4d_1'y_0^3}{3}+\frac{2y_0^3}{3}-6d_1y_0^2+6d_1'y_0^2-3y_0^2+12d_1y_0-12d_1'y_0+6y_0-$

$$
\frac{38d_1}{3}+10d'_1+4H(0;\alpha_0)+2H(0;Y)+4\,d_1H(1;\alpha_0)+\frac{8d_1}{y_0-1}-\frac{4\,d'_1}{y_0-1}-\frac{2}{y_0-1}-\frac{43}{3}\Big)\;H(1,1,c_1(\alpha_0);y_0)+
$$

$$
\Big(-\frac{4y_0^3}{3}+6y_0^2-12\,y_0-\frac{4}{y_0-1}+\frac{38}{3}\Big)\;H(1,c_1(\alpha_0),0;y_0)+\Big(-\frac{2d'_1y_0^3}{3}+3d'_1y_0^2-6d'_1\,y_0+\frac{19d'_1}{3}-
$$

$$
\frac{2d'_1}{y_0-1}\Big)\;H(1,c_1(\alpha_0),1;y_0)+\Big(-2y_0^3+9y_0^2-18y_0-4H(0;\alpha_0)-2\,H(0;Y)-4d_1H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2\,d'_1}{y_0-1}-
$$

$$
\frac{2}{y_0-1}+27\Big)\;H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\Big(-2\alpha_0d'_1+\frac{2d'_1}{y_0-1}+2\,d'_1\Big)H(c_1(\alpha_0),1,c_1(\alpha_0);y_0)+\Big(-4\,\alpha_0+
$$

$$
\frac{4}{y_0-1}+4\Big)H(c_1(\alpha_0),c_1(\alpha_0),0;y_0)+\Big(-2\alpha_0\,d'_1+\frac{2d'_1}{y_0-1}+2d'_1\Big)\;H(c_1(\alpha_0),c_1(\alpha_0),1;y_0)+\Big(-6\alpha_0+\frac{6}{y_0-1}+
$$

$$
6\Big)\;H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac14H(0,0,0,0;Y)-64\;H(0,0,0,0;y_0)-16d'_1H(0,0,0,1;y_0)+
$$

$$
16\;H(0,0,0,c_1(\alpha_0);y_0)-\frac14H(0,0,1,0;Y)+(8d_1-16d'_1-8)\;H(0,0,1,0;y_0)-4d'^2_1H(0,0,1,1;y_0)+
$$

$$
(-8d_1+4d'_1+8)H(0,0,1,c_1(\alpha_0);y_0)+8H(0,0,c_1(\alpha_0),0;y_0)+4d'_1H(0,0,c_1(\alpha_0),1;y_0)+
$$

$$
4\;H(0,0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac14H(0,1,0,0;Y)+(-16d'_1-24)\;H(0,1,0,0;y_0)+\Big(-4d'^2_1-
$$

$$
4d'_1\Big)H(0,1,0,1;y_0)+(-4d_1+4\;d'_1+8)H(0,1,0,c_1(\alpha_0);y_0)-\frac14H(0,1,1,0;Y)+\Big(-4\;d'^2_1-8d'_1+
$$

$$
12d_1\Big)H(0,1,1,0;y_0)-d'^3_1H(0,1,1,1;y_0)+(8\;d'_1-12d_1)H(0,1,1,c_1(\alpha_0);y_0)+
$$

$$
8H(0,1,c_1(\alpha_0),0;y_0)+4d'_1\;H(0,1,c_1(\alpha_0),1;y_0)+(4d_1-2d'_1+8)H(0,1,c_1(\alpha_0),c_1(\alpha_0);y_0)-
$$

$$
2\;d'_1H(0,c_1(\alpha_0),1,c_1(\alpha_0);y_0)-4H(0,c_1(\alpha_0),c_1(\alpha_0),0;y_0)-2\;d'_1H(0,c_1(\alpha_0),c_1(\alpha_0),1;y_0)-
$$

$$
6\;H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac14H(1,0,0,0;Y)+8\;H(1,0,0,c_1(\alpha_0);y_0)-\frac14H(1,0,1,0;Y)+
$$

$$
(4d_1-4)\;H(1,0,1,0;y_0)+(-4d_1+2d'_1+4)H(1,0,1,c_1(\alpha_0);y_0)+4\;H(1,0,c_1(\alpha_0),0;y_0)+
$$

$$
2d'_1H(1,0,c_1(\alpha_0),1;y_0)-2\;H(1,0,c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac14H(1,1,0,0;Y)-12\;H(1,1,0,0;y_0)-
$$

$$
2d'_1H(1,1,0,1;y_0)+(-4d_1+2d'_1+6)\;H(1,1,0,c_1(\alpha_0);y_0)-\frac14H(1,1,1,0;Y)+(8d_1-4d'_1-
$$

$$
2)\;H(1,1,1,0;y_0)+(-8d_1+4d'_1+2)H(1,1,1,c_1(\alpha_0);y_0)+4\;H(1,1,c_1(\alpha_0),0;y_0)+
$$

$$
2d'_1H(1,1,c_1(\alpha_0),1;y_0)+(4d_1-2d'_1+2)\;H(1,1,c_1(\alpha_0),c_1(\alpha_0);y_0)-2d'_1H(1,c_1(\alpha_0),1,c_1(\alpha_0);y_0)-
$$

$$
4\;H(1,c_1(\alpha_0),c_1(\alpha_0),0;y_0)-2d'_1H(1,c_1(\alpha_0),c_1(\alpha_0),1;y_0)-6\;H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)+
$$

$$
H(0;y_0)\Big(-\frac19y_0^3\;\alpha_0^4+\frac{5y_0^2\alpha_0^4}{6}-\frac{10y_0\alpha_0^4}{3}+\frac{13y_0^3\;\alpha_0^3}{27}-\frac{34y_0^2\alpha_0^3}{9}+\frac{160y_0\alpha_0^3}{9}-\frac{11\;y_0^3\alpha_0^2}{18}+\frac{109y_0^2\alpha_0^2}{18}-\frac{316y_0\;\alpha_0^2}{9}-\frac{7y_0^3\alpha_0}{9}-
$$

$$
\frac{7y_0^2\alpha_0}{9}+\frac{86y_0\;\alpha_0}{3}+\frac{4d'^2_1y_0^3}{27}-\frac{205d_1y_0^3}{108}-\frac{3\;d'_1y_0^3}{2}-\frac{2\pi^2y_0^3}{9}+\frac{161y_0^3}{27}-\frac{17\;d'^2_1y_0^2}{18}+\frac{22d_1y_0^2}{3}+\frac{98d'_1y_0^2}{9}+\pi^2y_0^2-\frac{1405y_0^2}{36}+
$$

$$
\frac{217\;d_1}{36}-\frac{d'_1}{6}+\frac{49d'^2_1y_0}{9}-\frac{469d_1\;y_0}{36}-\frac{1201d'_1y_0}{18}-2\pi^2y_0+\frac{1811\;y_0}{9}+\Big(\frac{7y_0^3}{3}-\frac{26y_0^2}{3}+11y_0-\frac{13}{3\;(y_0-1)}-\frac{13}{3}\Big)H(0;\alpha_0)+
$$

$$
\frac49d'_1y_0^3\;H(0;Y)-\frac{53}{18}y_0^3H(0;Y)-\frac73d'_1y_0^2\;H(0;Y)+\frac{49}{3}y_0^2H(0;Y)+\frac{22}{3}d'_1y_0\;H(0;Y)-\frac{107}{2}y_0H(0;Y)+
$$

$$
\frac{13H(0;Y)}{6\;(y_0-1)}-\frac16\pi^2H(0;Y)+\frac{13}{6}H(0;Y)-\frac16\;\pi^2H(1;Y)+\frac43y_0^3H(0,0;Y)-6y_0^2H(0,0;Y)+12y_0\;H(0,0;Y)+
$$

$$
\frac43y_0^3H(1,0;Y)-6y_0^2H(1,0;Y)+12y_0\;H(1,0;Y)-H(0,0,0;Y)-H(0,1,0;Y)-H(1,0,0;Y)-
$$

$$
H(1,1,0;Y)+\frac{217\;d_1}{36(y_0-1)}-\frac{d'_1}{6(y_0-1)}+\frac{4\pi^2}{3\;(y_0-1)}-\frac{149}{18(y_0-1)}-6\zeta_3+\frac{4\pi^{\;2}}{3}-\frac{149}{18}\Big)+H(1;y_0)\Big(-\frac1{18}d'_1y_0^3\;\alpha_0^4+
$$

$$
\frac5{12}d'_1y_0^2\alpha_0^4+\frac{47d'_1\;\alpha_0^4}{36}-\frac53d'_1y_0\alpha_0^4+\frac{13}{54}d'_1y_0^3\alpha_0^3-\frac{17}{9}d'_1y_0^2\alpha_0^3-\frac{391d'_1\alpha_0^3}{54}+\frac{80}{9}\;d'_1y_0\alpha_0^3-\frac{11}{36}d'_1y_0^3\alpha_0^2+\frac{109}{36}d'_1\;y_0^2\alpha_0^2+
$$

$$
\frac{89d'_1\alpha_0^2}{6}-\frac{158}{9}d'_1y_0\;\alpha_0^2-\frac7{18}d'_1y_0^3\alpha_0-\frac7{18}d'_1y_0^2\;\alpha_0-\frac{247d'_1\alpha_0}{18}+\frac{43d'_1y_0\alpha_0}{3}-\frac{251\;d'^3_1}{216}+\frac{d'^3_1y_0^3}{27}-\frac{8d'^2_1\;y_0^3}{27}+\frac{14d'_1y_0^3}{27}-
$$

$$
\frac1{18}d'_1\pi^2\;y_0^3-\frac{\pi^2y_0^3}{9}+\frac{395d'^2_1}{27}-\frac{17d'^3_1\;y_0^2}{72}+\frac{22d'^2_1y_0^2}{9}-\frac{21d'_1\;y_0^2}{4}+\frac14d'_1\pi^2y_0^2+\frac{\pi^2\;y_0^2}{2}-\frac{4025d'_1}{108}+\frac{49d'^3_1y_0}{36}-\frac{151\;d'^2_1y_0}{9}+
$$

$$
42d'_1y_0-\frac12d'_1\pi^2y_0-\pi^2\;y_0+\frac19d'^2_1y_0^3H(0;Y)-\frac49d'_1y_0^3\;H(0;Y)-\frac{49}{36}d'^2_1H(0;Y)-\frac7{12}d'^2_1y_0^2H(0;Y)+
$$

$$
3\;d'_1y_0^2H(0;Y)+\frac{85}{9}d'_1H(0;Y)+\frac{11}{6}d'^2_1y_0\;H(0;Y)-12d'_1y_0H(0;Y)-\frac13\pi^2H(0;Y)+H(0;\alpha_0)\;\Big(\frac{17d'_1y_0^3}{18}-
$$

$$
\frac23H(0;Y)y_0^3+\frac{37\;y_0^3}{18}-\frac{4d_1y_0^2}{3}-\frac{19d'_1y_0^2}{6}+3H(0;Y)\;y_0^2-\frac{35y_0^2}{3}+\frac{16d_1y_0}{3}+\frac{11d'_1y_0}{6}-6\;H(0;Y)y_0+\frac{209y_0}{6}-
$$

$$
\frac{37d_1}{18}+\frac{7\;d'_1}{18}-\frac{2H(0;Y)}{y_0-1}+\frac{19}{3}H(0;Y)+\frac{d_1}{3\;(y_0-1)}-\frac{d'_1}{6(y_0-1)}+\frac{37}{6\;(y_0-1)}-\frac{127}{3}\Big)+\Big(-\frac{4y_0^3}{3}+6y_0^2-12\;y_0-
$$

$$
\frac{4}{y_0-1}+\frac{38}{3}\Big)H(0,0;\alpha_0)+\frac13d'_1\;y_0^3H(0,0;Y)-\frac32d'_1y_0^2H(0,0;Y)-\frac{11}{6}d'_1\;H(0,0;Y)+3d'_1y_0H(0,0;Y)+
$$

$$
\Big(-\frac{4d_1y_0^3}{3}+6d_1\;y_0^2-12d_1y_0+\frac{38d_1}{3}-\frac{4d_1}{y_0-1}\Big)\;H(0,1;\alpha_0)+\frac13d'_1y_0^3H(1,0;Y)-\frac32d'_1y_0^2\;H(1,0;Y)-
$$

$\frac{11}{6}d_1' H(1,0;Y)+3d_1' y_0 H(1,0;Y)-\frac{2d_1\pi^2}{3(y_0-1)}+\frac{d_1'\pi^2}{3(y_0-1)}+\frac{\pi^2}{3(y_0-1)}+6\zeta_3+\frac{11d_1'\pi^2}{36}+\frac{43\pi^2}{18}\Big)+\frac{2d_1\pi^2}{3(y_0-1)}-\frac{d_1'\pi^2}{3(y_0-1)}-\frac{37\pi^2}{36(y_0-1)}+4y_0^3\zeta_3-18y_0^2\zeta_3+36y_0\zeta_3-\frac{3}{2}H(0;Y)\zeta_3-\frac{6\zeta_3}{y_0-1}-6\zeta_3+\frac{\pi^4}{288}+\frac{2d_1\pi^2}{3}-\frac{d_1'\pi^2}{3}-\frac{37\pi^2}{36}.$

G. The $\mathcal{K}{*}\mathcal{I}$-type integrals

G.1 The $\mathcal{K}{*}\mathcal{I}$ integral for $k=0$

The ε expansion for this integral reads

$$\mathcal{K}{*}\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;0)=\frac{1}{\varepsilon^3}(k*i)_{-3}^{(0)}+\frac{1}{\varepsilon^2}(k*i)_{-2}^{(0)}+\frac{1}{\varepsilon}(k*i)_{-1}^{(0)}+(k*i)_{0}^{(0)}+\mathcal{O}(\varepsilon)\,, \qquad \text{(G.1)}$$

where

$(k*i)_{-3}^{(0)}=-\frac{1}{2},$

$(k*i)_{-2}^{(0)}=-\frac{2y_0^3}{3}+3y_0^2-6y_0+2H(0;y_0)-1,$

$(k*i)_{-1}^{(0)}=\frac{y_0^3\alpha_0^4}{6}-\frac{y_0^2\alpha_0^4}{2}+\frac{y_0\alpha_0^4}{2}-\frac{8y_0^3\alpha_0^3}{9}+3y_0^2\alpha_0^3-\frac{10y_0\alpha_0^3}{3}+2y_0^3\alpha_0^2-\frac{15y_0^2\alpha_0^2}{2}+10y_0\alpha_0^2-\frac{8y_0^3\alpha_0}{3}+11y_0^2\alpha_0-18y_0\alpha_0+\frac{2d_1'y_0^3}{9}-\frac{8y_0^3}{3}-\frac{7d_1'y_0^2}{6}+\frac{25y_0^2}{2}+\frac{11d_1'y_0}{3}-32y_0+\Big(\frac{2y_0^3}{3}-3y_0^2+6y_0-\frac{2}{y_0-1}-2\Big)H(0;\alpha_0)+\Big(2y_0^3-9y_0^2+18y_0+\frac{2}{y_0-1}+6\Big)H(0;y_0)+\Big(\frac{2d_1'y_0^3}{3}-3d_1'y_0^2+6d_1'y_0-\frac{11d_1'}{3}+2H(0;\alpha_0)\Big)H(1;y_0)+\Big(2\alpha_0-\frac{2}{y_0-1}-2\Big)H(c_1(\alpha_0);y_0)-8H(0,0;y_0)-2d_1'H(0,1;y_0)+2H(0,c_1(\alpha_0);y_0)-2H(1,0;y_0)+2H(1,c_1(\alpha_0);y_0)-2,$

$(k*i)_{0}^{(0)}=-\frac{1}{12}d_1y_0^3\alpha_0^4-\frac{1}{18}d_1'y_0^3\alpha_0^4+\frac{3y_0^3\alpha_0^4}{4}+\frac{1}{4}d_1y_0^2\alpha_0^4+\frac{1}{6}d_1'y_0^2\alpha_0^4-\frac{13y_0^2\alpha_0^4}{6}-\frac{1}{4}d_1y_0\alpha_0^4-\frac{1}{6}d_1'y_0\alpha_0^4+\frac{29y_0\alpha_0^4}{12}+\frac{13}{27}d_1y_0^3\alpha_0^3+\frac{8}{27}d_1'y_0^3\alpha_0^3-\frac{221y_0^3\alpha_0^3}{54}-\frac{5}{3}d_1y_0^2\alpha_0^3-\frac{19}{18}d_1'y_0^2\alpha_0^3+\frac{247y_0^2\alpha_0^3}{18}+\frac{17}{9}d_1y_0\alpha_0^3+\frac{11}{9}d_1'y_0\alpha_0^3-\frac{305y_0\alpha_0^3}{18}-\frac{23}{18}d_1y_0^3\alpha_0^2-\frac{2}{3}d_1'y_0^3\alpha_0^2+\frac{347y_0^3\alpha_0^2}{36}+5d_1y_0^2\alpha_0^2+\frac{11}{4}d_1'y_0^2\alpha_0^2-\frac{331y_0^2\alpha_0^2}{9}-\frac{43}{6}d_1y_0\alpha_0^2-\frac{9}{2}d_1'y_0\alpha_0^2+\frac{1021y_0\alpha_0^2}{18}+\frac{25}{9}d_1y_0^3\alpha_0+\frac{8}{9}d_1'y_0^3\alpha_0-\frac{265y_0^3\alpha_0}{18}-12d_1y_0^2\alpha_0-\frac{25}{6}d_1'y_0^2\alpha_0+\frac{566y_0^2\alpha_0}{9}+\frac{65d_1y_0\alpha_0}{3}+\frac{29d_1'y_0\alpha_0}{3}-\frac{245y_0\alpha_0}{2}-\frac{\alpha_0}{y_0-1}-\alpha_0-\frac{2d_1'^2y_0^3}{27}+\frac{10d_1'y_0^3}{9}+\frac{\pi^2y_0^3}{9}-8y_0^3+\frac{17d_1'^2y_0^2}{36}-\frac{20d_1'y_0^2}{3}-\frac{\pi^2y_0^2}{2}+\frac{155y_0^2}{4}-\frac{49d_1'^2y_0}{18}+\frac{199d_1'y_0}{6}+\pi^2y_0-128y_0+\Big(-\frac{1}{3}y_0^3\alpha_0^4+y_0^2\alpha_0^4-y_0\alpha_0^4+\frac{16y_0^3\alpha_0^3}{9}-6y_0^2\alpha_0^3+\frac{20y_0\alpha_0^3}{3}-4y_0^3\alpha_0^2+15y_0^2\alpha_0^2-20y_0\alpha_0^2+\frac{16y_0^3\alpha_0}{3}-22y_0^2\alpha_0+36y_0\alpha_0-\frac{2d_1'y_0^3}{9}+\frac{23y_0^3}{18}+\frac{7d_1'y_0^2}{6}-\frac{43y_0^2}{6}+4d_1-2d_1'-\frac{11d_1'y_0}{3}+\frac{143y_0}{6}+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{61}{6(y_0-1)}-\frac{1}{(y_0-1)^2}-\frac{55}{6}\Big)H(0;\alpha_0)+\Big(-\frac{1}{3}y_0^3\alpha_0^4+y_0^2\alpha_0^4-y_0\alpha_0^4+\frac{16y_0^3\alpha_0^3}{9}-6y_0^2\alpha_0^3+\frac{20y_0\alpha_0^3}{3}-4y_0^3\alpha_0^2+15y_0^2\alpha_0^2-20y_0\alpha_0^2+\frac{16y_0^3\alpha_0}{3}-22y_0^2\alpha_0+36y_0\alpha_0-\frac{2d_1'y_0^3}{3}+\frac{169y_0^3}{18}+\frac{7d_1'y_0^2}{2}-\frac{257y_0^2}{6}-4d_1+2d_1'-11d_1'y_0+\frac{625y_0}{6}+\Big(-\frac{4y_0^3}{3}+6y_0^2-12y_0+\frac{4}{y_0-1}+4\Big)H(0;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{61}{6(y_0-1)}+\frac{1}{(y_0-1)^2}+\frac{103}{6}\Big)H(0;y_0)+\Big(-\frac{1}{3}d_1y_0^3\alpha_0^4+d_1y_0^2\alpha_0^4-d_1y_0\alpha_0^4+\frac{16}{9}d_1y_0^3\alpha_0^3-6d_1y_0^2\alpha_0^3+\frac{20}{3}d_1y_0\alpha_0^3-4d_1y_0^3\alpha_0^2+15d_1y_0^2\alpha_0^2-20d_1y_0\alpha_0^2+\frac{16}{3}d_1y_0^3\alpha_0-22d_1y_0^2\alpha_0+36d_1y_0\alpha_0-\frac{25d_1y_0^3}{9}+12d_1y_0^2-\frac{65d_1y_0}{3}\Big)H(1;\alpha_0)+\Big(-\frac{1}{6}y_0^3\alpha_0^4+\frac{y_0^2\alpha_0^4}{2}-\frac{y_0\alpha_0^4}{2}+\frac{\alpha_0^4}{6}+\frac{8y_0^3\alpha_0^3}{9}-3y_0^2\alpha_0^3+\frac{10y_0\alpha_0^3}{3}-\frac{11\alpha_0^3}{9}-2y_0^3\alpha_0^2+\frac{15y_0^2\alpha_0^2}{2}-10y_0\alpha_0^2+\frac{11\alpha_0^2}{2}+\frac{8y_0^3\alpha_0}{3}-11y_0^2\alpha_0-4d_1\alpha_0+2d_1'\alpha_0+18y_0\alpha_0-\frac{25y_0^3}{18}+\frac{16y_0^2}{3}+4d_1-2d_1'-\frac{49y_0}{6}+\Big(-4\alpha_0+\frac{4}{y_0-1}+4\Big)H(0;\alpha_0)+\Big(-4\alpha_0d_1+\frac{4d_1}{y_0-1}+4d_1\Big)H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{61}{6(y_0-1)}-\frac{1}{(y_0-1)^2}-\frac{55}{6}\Big)H(c_1(\alpha_0);y_0)+\Big(-\frac{4y_0^3}{3}+6y_0^2-12y_0+\frac{4}{y_0-1}+4\Big)H(0,0;\alpha_0)+\Big(-\frac{20y_0^3}{3}+30y_0^2-60y_0-\frac{12}{y_0-1}-28\Big)H(0,0;y_0)+\Big(-\frac{4d_1y_0^3}{3}+6d_1y_0^2-12d_1y_0+4d_1+\frac{4d_1}{y_0-1}\Big)H(0,1;\alpha_0)+$

$H(1;y_0)\Big(-\frac{1}{6}d_1'y_0^3\alpha_0^4+\frac{1}{2}\ d_1'y_0^2\alpha_0^4+\frac{d_1'\alpha_0^4}{6}-\frac{1}{2}d_1'y_0\ \alpha_0^4+\frac{8}{9}d_1'y_0^3\alpha_0^3-3d_1'y_0^2\alpha_0^3-\frac{11d_1'\ \alpha_0^3}{9}+\frac{10}{3}d_1'y_0\alpha_0^3-2d_1'y_0^3\alpha_0^2+\frac{15}{2}\ d_1'y_0^2\alpha_0^2+\frac{9d_1'\alpha_0^2}{2}-10d_1'y_0\alpha_0^2+\frac{8}{3}\ d_1'y_0^3\alpha_0-11d_1'y_0^2\alpha_0-\frac{23d_1'\alpha_0}{3}+18d_1'y_0\ \alpha_0-\frac{2d_1'^2y_0^3}{9}+\frac{8d_1'y_0^3}{3}+\frac{49\ d_1'^2}{18}+\frac{7d_1'^2y_0^2}{6}-\frac{25d_1'\ y_0^2}{2}-\frac{133d_1'}{6}-\frac{11d_1'^2y_0}{3}+32d_1'\ y_0+\Big(-\frac{2d_1'y_0^3}{3}+\frac{2y_0^3}{3}+3d_1'y_0^2-3\ y_0^2-6d_1'y_0+6y_0+\frac{11d_1'}{3}-\frac{4d_1}{y_0-1}+\frac{2\ d_1'}{y_0-1}+\frac{2}{y_0-1}+10\Big)H(0;\alpha_0)-4H(0,0;\alpha_0)-4d_1\ H(0,1;\alpha_0)+\frac{\pi^2}{3}\Big)+\Big(-2d_1'y_0^3+9d_1'y_0^2-18\ d_1'y_0-6d_1'+(4d_1-4)H(0;\alpha_0)-\frac{2d_1'}{y_0-1}\Big)\ H(0,1;y_0)+\Big(\frac{2y_0^3}{3}-3y_0^2+6y_0-4H(0;\alpha_0)-4d_1H(1;\ \alpha_0)+\frac{6}{y_0-1}+10\Big)H(0,c_1(\alpha_0);y_0)+\Big(-2d_1'\ y_0^3-\frac{2y_0^3}{3}+9d_1'y_0^2+3y_0^2-18d_1'y_0-6y_0+11\ d_1'-4H(0;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2\ d_1'}{y_0-1}-\frac{2}{y_0-1}-10\Big)H(1,0;y_0)+\Big(-\frac{2}{3}\ d_1'^2y_0^3+3d_1'^2y_0^2-6d_1'^2y_0+\frac{11d_1'^2}{3}+(4d_1-2\ d_1'-2)H(0;\alpha_0)\Big)H(1,1;y_0)+\Big(\frac{2y_0^3}{3}-3y_0^2+6\ y_0-4H(0;\alpha_0)-4d_1H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2\ d_1'}{y_0-1}+\frac{2}{y_0-1}+10\Big)H(1,c_1(\alpha_0);y_0)+\Big(-4\ \alpha_0+\frac{4}{y_0-1}+4\Big)H(c_1(\alpha_0),0;y_0)+\Big(-2\alpha_0d_1'+\frac{2\ d_1'}{y_0-1}+2d_1'\Big)H(c_1(\alpha_0),1;y_0)+\Big(-2\ \alpha_0+\frac{2}{y_0-1}+2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+32H(0,0,0;y_0)+8\ d_1'H(0,0,1;y_0)-8H(0,0,c_1(\alpha_0);y_0)+(-4d_1+8d_1'+4)\ H(0,1,0;y_0)+2d_1'^2H(0,1,1;y_0)+(4d_1-2d_1'-4)\ H(0,1,c_1(\alpha_0);y_0)-4H(0,c_1(\alpha_0),0;y_0)-2d_1'\ H(0,c_1(\alpha_0),1;y_0)-2H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+12H(1,0,0;y_0)+2\ d_1'H(1,0,1;y_0)-6H(1,0,c_1(\alpha_0);y_0)+(-4d_1+2d_1'+2)\ H(1,1,0;y_0)+(4d_1-2d_1'-2)H(1,1,c_1(\alpha_0);y_0)-4\ H(1,c_1(\alpha_0),0;y_0)-2d_1'H(1,c_1(\alpha_0),1;y_0)-2\ H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac{\pi^2}{3(y_0-1)}+3\ \zeta_3-\frac{\pi^2}{3}-4.$

G.2 The $\mathcal{K}\!*\!\mathcal{I}$ integral for $k=1$

The ε expansion for this integral reads

$$\mathcal{K}\!*\!\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^3}(k*i)_{-3}^{(1)}+\frac{1}{\varepsilon^2}(k*i)_{-2}^{(1)}+\frac{1}{\varepsilon}(k*i)_{-1}^{(1)}+(k*i)_0^{(1)}+\mathcal{O}(\varepsilon)\,, \qquad (G.2)$$

where

$(k*i)_{-3}^{(1)}=-\frac{1}{4},$

$(k*i)_{-2}^{(1)}=-\frac{y_0^3}{3}+\frac{3y_0^2}{2}-3y_0+H(0;y_0)-\frac{1}{2},$

$(k*i)_{-1}^{(1)}=\frac{y_0^3\alpha_0^4}{12}-\frac{y_0^2\alpha_0^4}{4}+\frac{y_0\ \alpha_0^4}{4}-\frac{4y_0^3\alpha_0^3}{9}+\frac{3y_0^2\alpha_0^3}{2}-\frac{5y_0\ \alpha_0^3}{3}+y_0^3\alpha_0^2-\frac{15y_0^2\alpha_0^2}{4}+5y_0\alpha_0^2-\frac{4\ y_0^3\alpha_0}{3}+\frac{11y_0^2\alpha_0}{2}-9y_0\alpha_0+\frac{d_1'\ y_0^3}{9}-\frac{4y_0^3}{3}-\frac{7d_1'y_0^2}{12}+\frac{25\ y_0^2}{4}+\frac{11d_1'y_0}{6}-16y_0+\Big(\frac{y_0^3}{3}-\frac{3\ y_0^2}{2}+3y_0-\frac{1}{y_0-1}-1\Big)H(0;\alpha_0)+\Big(y_0^3-\frac{9\ y_0^2}{2}+9y_0+\frac{1}{y_0-1}+3\Big)H(0;y_0)+\Big(\frac{d_1'\ y_0^3}{3}-\frac{3d_1'y_0^2}{2}+3d_1'y_0-\frac{11\ d_1'}{6}+H(0;\alpha_0)\Big)H(1;y_0)+\Big(\alpha_0-\frac{1}{y_0-1}-1\Big)\ H(c_1(\alpha_0);y_0)-4H(0,0;y_0)-d_1'H(0,1;y_0)+H(0,c_1(\alpha_0);y_0)-H(1,0;\ y_0)+H(1,c_1(\alpha_0);y_0)-1,$

$(k*i)_0^{(1)}=-\frac{1}{24}d_1y_0^3\alpha_0^4-\frac{1}{36}d_1'y_0^3\alpha_0^4+\frac{3\ y_0^3\alpha_0^4}{8}+\frac{1}{8}d_1y_0^2\alpha_0^4+\frac{1}{12}d_1'y_0^2\ \alpha_0^4-\frac{13y_0^2\alpha_0^4}{12}-\frac{1}{8}d_1y_0\ \alpha_0^4-\frac{1}{12}d_1'y_0\alpha_0^4+\frac{29y_0\ \alpha_0^4}{24}+\frac{13}{54}d_1y_0^3\alpha_0^3+\frac{4}{27}d_1'y_0^3\ \alpha_0^3-\frac{221y_0^3\alpha_0^3}{108}-\frac{5}{6}d_1y_0^2\ \alpha_0^3-\frac{19}{36}d_1'y_0^2\alpha_0^3+\frac{247y_0^2\ \alpha_0^3}{36}+\frac{17}{18}d_1y_0\alpha_0^3+\frac{11}{18}d_1'y_0\ \alpha_0^3-\frac{305y_0\alpha_0^3}{36}-\frac{23}{36}d_1y_0^3\ \alpha_0^2-\frac{1}{3}d_1'y_0^3\alpha_0^2+\frac{347y_0^3\ \alpha_0^2}{72}+\frac{5}{2}d_1y_0^2\alpha_0^2+\frac{11}{8}d_1'y_0^2\alpha_0^2-\frac{331y_0^2\alpha_0^2}{18}-\frac{43}{12}d_1y_0\alpha_0^2-\frac{9}{4}\ d_1'y_0\alpha_0^2+\frac{1021y_0\alpha_0^2}{36}+\frac{25}{18}d_1y_0^3\alpha_0+\ \frac{4}{9}d_1'y_0^3\alpha_0-\frac{265y_0^3\alpha_0}{36}-6d_1y_0^2\ \alpha_0-\frac{25}{12}d_1'y_0^2\alpha_0+\frac{283y_0^2\alpha_0}{9}+\frac{65d_1\ y_0\alpha_0}{6}+\frac{29d_1'y_0\alpha_0}{6}-\frac{245y_0\ \alpha_0}{4}-\frac{\alpha_0}{2(y_0-1)}-\frac{\alpha_0}{2}-\frac{d_1'^2\ y_0^3}{27}+\frac{5d_1'y_0^3}{9}+\frac{\pi^2y_0^3}{18}-4\ y_0^3+\frac{17d_1'^2y_0^2}{72}-\frac{10d_1'y_0^2}{3}-\frac{\pi^2\ y_0^2}{4}+\frac{155y_0^2}{8}-\frac{49d_1'^2y_0}{36}+\frac{199d_1'\ y_0}{12}+\frac{\pi^2y_0}{2}-64y_0+\Big(-\frac{1}{6}y_0^3\ \alpha_0^4+\frac{y_0^2\alpha_0^4}{2}-\frac{y_0\alpha_0^4}{2}+\frac{8y_0^3\ \alpha_0^3}{9}-3y_0^2\alpha_0^3+\frac{10y_0\alpha_0^3}{3}-2y_0^3\alpha_0^2+\frac{15\ y_0^2\alpha_0^2}{2}-10y_0\alpha_0^2+\frac{8y_0^3\alpha_0}{3}-11y_0^2\alpha_0+18\ y_0\alpha_0-\frac{d_1'y_0^3}{9}+\frac{23y_0^3}{36}+\frac{7d_1'\ y_0^2}{12}-\frac{43y_0^2}{12}+2d_1-d_1'-\frac{11d_1'\ y_0}{6}+\frac{143y_0}{12}+\frac{2\ d_1}{y_0-1}-$

$$
\begin{aligned}
&\frac{d_1'}{y_0-1}-\frac{61}{12(y_0-1)}-\frac{1}{2\ (y_0-1)^2}-\frac{55}{12}\Big)H(0;\alpha_0)+\Big(-\frac{1}{6}y_0^3\alpha_0^4+\frac{y_0^2\alpha_0^4}{2}-\frac{y_0\alpha_0^4}{2}+\frac{8y_0^3\alpha_0^3}{9}-3\ y_0^2\alpha_0^3+\frac{10y_0\alpha_0^3}{3}-2y_0^3\alpha_0^2+\\
&\frac{15y_0^2\ \alpha_0^2}{2}-10y_0\alpha_0^2+\frac{8y_0^3\alpha_0}{3}-11y_0^2\alpha_0+18y_0\alpha_0-\frac{d_1'y_0^3}{3}+\frac{169y_0^3}{36}+\frac{7d_1'\ y_0^2}{4}-\frac{257y_0^2}{12}-2d_1+d_1'-\frac{11d_1'\ y_0}{2}+\frac{625y_0}{12}+\\
&\Big(-\frac{2y_0^3}{3}+3y_0^2-6\ y_0+\frac{2}{y_0-1}+2\Big)H(0;\alpha_0)-\frac{2\ d_1}{y_0-1}+\frac{d_1'}{y_0-1}+\frac{61}{12(y_0-1)}+\frac{1}{2\ (y_0-1)^2}+\frac{103}{12}\Big)H(0;y_0)+\Big(-\\
&\frac{1}{6}d_1y_0^3\ \alpha_0^4+\frac{1}{2}d_1y_0^2\alpha_0^4-\frac{1}{2}d_1y_0\ \alpha_0^4+\frac{8}{9}d_1y_0^3\alpha_0^3-3d_1y_0^2\alpha_0^3+\frac{10}{3}d_1\ y_0\alpha_0^3-2d_1y_0^3\alpha_0^2+\frac{15}{2}d_1y_0^2\alpha_0^2-10d_1y_0\ \alpha_0^2+\\
&\frac{8}{3}d_1y_0^3\alpha_0-11d_1y_0^2\alpha_0+18d_1y_0\ \alpha_0-\frac{25d_1y_0^3}{18}+6d_1y_0^2-\frac{65d_1y_0}{6}\Big)\ H(1;\alpha_0)+\Big(-\frac{1}{12}y_0^3\alpha_0^4+\frac{y_0^2\ \alpha_0^4}{4}-\frac{y_0\alpha_0^4}{4}+\\
&\frac{\alpha_0^4}{12}+\frac{4y_0^3\ \alpha_0^3}{9}-\frac{3y_0^2\alpha_0^3}{2}+\frac{5y_0\alpha_0^3}{3}-\frac{11\ \alpha_0^3}{18}-y_0^3\alpha_0^2+\frac{15y_0^2\alpha_0^2}{4}-5y_0\alpha_0^2+\frac{11\ \alpha_0^2}{4}+\frac{4y_0^3\alpha_0}{3}-\frac{11y_0^2\alpha_0}{2}-2d_1\alpha_0+d_1'\ \alpha_0+\\
&9y_0\alpha_0-\frac{25y_0^3}{36}+\frac{8y_0^2}{3}+2\ d_1-d_1'-\frac{49y_0}{12}+\Big(-2\alpha_0+\frac{2}{y_0-1}+2\Big)\ H(0;\alpha_0)+\Big(-2\alpha_0d_1+\frac{2d_1}{y_0-1}+2d_1\Big)\ H(1;\alpha_0)+\\
&\frac{2d_1}{y_0-1}-\frac{d_1'}{y_0-1}-\frac{61}{12\ (y_0-1)}-\frac{1}{2(y_0-1)^2}-\frac{55}{12}\Big)\ H(c_1(\alpha_0);y_0)+\Big(-\frac{2y_0^3}{3}+3y_0^2-6\ y_0+\frac{2}{y_0-1}+2\Big)H(0,0;\alpha_0)+\\
&\Big(-\frac{10y_0^3}{3}+15\ y_0^2-30y_0-\frac{6}{y_0-1}-14\Big)H(0,0;y_0)+\Big(-\frac{2d_1\ y_0^3}{3}+3d_1y_0^2-6d_1y_0+2d_1+\frac{2d_1}{y_0-1}\Big)H(0,1;\ \alpha_0)+\\
&H(1;y_0)\Big(-\frac{1}{12}d_1'y_0^3\alpha_0^4+\frac{1}{4}d_1'\ y_0^2\alpha_0^4+\frac{d_1'\alpha_0^4}{12}-\frac{1}{4}d_1'y_0\ \alpha_0^4+\frac{4}{9}d_1'y_0^3\alpha_0^3-\frac{3}{2}d_1'y_0^2\ \alpha_0^3-\frac{11d_1'\alpha_0^3}{18}+\frac{5}{3}d_1'y_0\alpha_0^3-\\
&d_1'y_0^3\ \alpha_0^2+\frac{15}{4}d_1'y_0^2\alpha_0^2+\frac{9d_1'\alpha_0^2}{4}-5d_1'y_0\ \alpha_0^2+\frac{4}{3}d_1'y_0^3\alpha_0-\frac{11}{2}d_1'y_0^2\alpha_0-\frac{23\ d_1'\alpha_0}{6}+9d_1'y_0\alpha_0-\frac{d_1'^2y_0^3}{9}+\frac{4d_1'\ y_0^3}{3}+\\
&\frac{49d_1'^2}{36}+\frac{7d_1'^2y_0^2}{12}-\frac{25\ d_1'y_0^2}{4}-\frac{133d_1'}{12}-\frac{11d_1'^2y_0}{6}+16d_1'\ y_0+\Big(-\frac{d_1'y_0^3}{3}+\frac{y_0^3}{3}+\frac{3d_1'\ y_0^2}{2}-\frac{3y_0^2}{2}-3d_1'y_0+3y_0+\frac{11\ d_1'}{6}-\\
&\frac{2\ d_1}{y_0-1}+\frac{d_1'}{y_0-1}+\frac{1}{y_0-1}+5\Big)H(0;\alpha_0)-2\ H(0,0;\alpha_0)-2d_1H(0,1;\alpha_0)+\frac{\pi^2}{6}\Big)+\Big(-d_1'\ y_0^3+\frac{9d_1'y_0^2}{2}-9d_1'y_0-\\
&3d_1'+(2d_1-2)\ H(0;\alpha_0)-\frac{d_1'}{y_0-1}\Big)\ H(0,1;y_0)+\Big(\frac{y_0^3}{3}-\frac{3y_0^2}{2}+3y_0-2H(0;\alpha_0)-2\ d_1H(1;\alpha_0)+\frac{3}{y_0-1}+\\
&5\Big)H(0,c_1(\alpha_0);y_0)+\Big(-d_1'\ y_0^3-\frac{y_0^3}{3}+\frac{9d_1'y_0^2}{2}+\frac{3y_0^2}{2}-9d_1'\ y_0-3y_0+\frac{11d_1'}{2}-2H(0;\alpha_0)+\frac{2\ d_1}{y_0-1}-\frac{d_1'}{y_0-1}-\\
&\frac{1}{y_0-1}-5\Big)\ H(1,0;y_0)+\Big(-\frac{1}{3}d_1'^2y_0^3+\frac{3d_1'^2y_0^2}{2}-3\ d_1'^2y_0+\frac{11d_1'^2}{6}+(2d_1-d_1'-1)H(0;\alpha_0)\Big)\ H(1,1;y_0)+\\
&\Big(\frac{y_0^3}{3}-\frac{3y_0^2}{2}+3y_0-2H(0;\alpha_0)-2\ d_1H(1;\alpha_0)-\frac{2d_1}{y_0-1}+\frac{d_1'}{y_0-1}+\frac{1}{y_0-1}+5\ \Big)H(1,c_1(\alpha_0);y_0)+\Big(-\\
&2\alpha_0+\frac{2}{y_0-1}+2\Big)\ H(c_1(\alpha_0),0;y_0)+\Big(-\alpha_0d_1'+\frac{d_1'}{y_0-1}+d_1'\Big)\ H(c_1(\alpha_0),1;y_0)+\Big(-\alpha_0+\frac{1}{y_0-1}+\\
&1\Big)\ H(c_1(\alpha_0),c_1(\alpha_0);y_0)+16H(0,0,0;y_0)+4d_1'H(0,0,1;y_0)-4\ H(0,0,c_1(\alpha_0);y_0)+(-2d_1+\\
&4d_1'+2)H(0,1,0;y_0)+d_1'^2\ H(0,1,1;y_0)+(2d_1-d_1'-2)H(0,1,c_1(\alpha_0);y_0)-2\ H(0,c_1(\alpha_0),0;y_0)-\\
&d_1'\ H(0,c_1(\alpha_0),1;y_0)-H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+6H(1,0,0;y_0)+d_1'\ H(1,0,1;y_0)-\\
&3H(1,0,c_1(\alpha_0);y_0)+(-2d_1+d_1'+1)H(1,1,0;y_0)+(2\ d_1-d_1'-1)H(1,1,c_1(\alpha_0);y_0)-\\
&2H(1,c_1(\alpha_0),0;y_0)-d_1'\ H(1,c_1(\alpha_0),1;y_0)-H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)-\frac{\pi^2}{6\ (y_0-1)}+\frac{3\zeta_3}{2}-\frac{\pi^2}{6}-2.
\end{aligned}
$$

G.3 The $\mathcal{K}{*}\mathcal{I}$ integral for $k=2$

The ε expansion for this integral reads

$$
\mathcal{K}{*}\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^3}(k*i)_{-3}^{(2)}+\frac{1}{\varepsilon^2}(k*i)_{-2}^{(2)}+\frac{1}{\varepsilon}(k*i)_{-1}^{(2)}+(k*i)_{0}^{(2)}+\mathcal{O}\left(\varepsilon\right), \qquad \text{(G.3)}
$$

where

$$(k*i)_{-3}^{(2)}=-\tfrac{1}{6},$$

$$(k*i)_{-2}^{(2)}=-\tfrac{2y_0^3}{9}+y_0^2-2y_0+\tfrac{2}{3}H(0;y_0)-\tfrac{4}{9},$$

$$
\begin{aligned}
&(k*i)_{-1}^{(2)}=\frac{y_0^3\alpha_0^4}{18}-\frac{y_0^2\alpha_0^4}{12}+\frac{y_0\ \alpha_0^4}{3}-\frac{\alpha_0^4}{6(y_0-2)}-\frac{\alpha_0^4}{12}-\frac{8y_0^3\ \alpha_0^3}{27}+\frac{2y_0^2\alpha_0^3}{3}-\frac{8y_0\ \alpha_0^3}{9}-\frac{\alpha_0^3}{y_0-2}-\frac{4\alpha_0^3}{9(y_0-2)^2}-\\
&\frac{7\ \alpha_0^3}{18}+\frac{2y_0^3\alpha_0^2}{3}-2y_0^2\alpha_0^2+\frac{5y_0\ \alpha_0^2}{3}-\frac{8\alpha_0^2}{3(y_0-2)}-\frac{11\alpha_0^2}{3\ (y_0-2)^2}-\frac{4\alpha_0^2}{3(y_0-2)^3}-\frac{7\alpha_0^2}{12}-\frac{8\ y_0^3\alpha_0}{9}+\frac{10y_0^2\alpha_0}{3}-4y_0\alpha_0-
\end{aligned}
$$

$$\frac{13\alpha_0}{3(y_0-2)} - \frac{18\alpha_0}{(y_0-2)^2} - \frac{52\alpha_0}{3(y_0-2)^3} - \frac{16\alpha_0}{3(y_0-2)^4} + \frac{\alpha_0}{2} + \frac{2d_1' y_0^3}{27} - \frac{25 y_0^3}{27} - \frac{7d_1' y_0^2}{18} + \frac{13y_0^2}{3} + \frac{11d_1' y_0}{9} - 11y_0 + \Big(\frac{2y_0^3}{9} -$$
$$y_0^2 + 2y_0 - \frac{2}{3(y_0-1)} - \frac{80}{3(y_0-2)^2} - \frac{160}{3(y_0-2)^3} - \frac{40}{(y_0-2)^4} - \frac{32}{3(y_0-2)^5} + \frac32\Big) H(0;\alpha_0) + \Big(\frac{2y_0^3}{3} - 3y_0^2 + 6y_0 +$$
$$\frac{2}{3(y_0-1)} + \frac{80}{3(y_0-2)^2} + \frac{160}{3(y_0-2)^3} + \frac{40}{(y_0-2)^4} + \frac{32}{3(y_0-2)^5} + \frac{5}{18}\Big) H(0;y_0) + \Big(\frac{2d_1' y_0^3}{9} - d_1' y_0^2 + 2d_1' y_0 - \frac{11 d_1'}{9} +$$
$$\frac23 H(0;\alpha_0)\Big) H(1;y_0) + \Big(\frac{2\alpha_0}{3} - \frac{2}{3(y_0-1)} - \frac23\Big) H(c_1(\alpha_0);y_0) + \Big(\frac{\alpha_0^4}{2} + \frac{2\alpha_0^3}{3} - \alpha_0^2 - 2\alpha_0 - \frac{80}{3(y_0-2)^2} -$$
$$\frac{160}{3(y_0-2)^3} - \frac{40}{(y_0-2)^4} - \frac{32}{3(y_0-2)^5} + \frac{11}{6}\Big) H(c_2(\alpha_0);y_0) - \frac83 H(0,0;y_0) - \frac23 d_1' H(0,1;y_0) + \frac23 H(0,c_1(\alpha_0);y_0) -$$
$$\frac23 H(1,0;y_0) + \frac23 H(1,c_1(\alpha_0);y_0) - \frac{80\ln 2}{3(y_0-2)^2} - \frac{160\ln 2}{3(y_0-2)^3} - \frac{40\ln 2}{(y_0-2)^4} - \frac{32\ln 2}{3(y_0-2)^5} + \frac{13\ln 2}{6} - \frac{26}{27},$$

$$(k*i)_0^{(2)} =$$
$$-\frac{1}{36}d_1 y_0^3\alpha_0^4 - \frac{1}{54}d_1' y_0^3\alpha_0^4 + \frac{7y_0^3\alpha_0^4}{27} + \frac{1}{24}d_1 y_0^2\alpha_0^4 + \frac{1}{72}d_1' y_0^2\alpha_0^4 - \frac{5y_0^2\alpha_0^4}{18} + \frac{d_1\alpha_0^4}{24} - \frac16 d_1 y_0\alpha_0^4 - \frac{11}{36}d_1' y_0\alpha_0^4 + \frac{41 y_0\alpha_0^4}{18} +$$
$$\frac{d_1\alpha_0^4}{12(y_0-2)} - \frac{31\alpha_0^4}{36(y_0-2)} - \frac{31\alpha_0^4}{72} + \frac{13}{81}d_1 y_0^3\alpha_0^3 + \frac{8}{81}d_1' y_0^3\alpha_0^3 - \frac{229 y_0^3\alpha_0^3}{162} - \frac{7}{18}d_1 y_0^2\alpha_0^3 - \frac{5}{27}d_1' y_0^2\alpha_0^3 + \frac{305 y_0^2\alpha_0^3}{108} + \frac{43 d_1\alpha_0^3}{108} -$$
$$\frac{d_1'\alpha_0^3}{18} + \frac{10}{27}d_1 y_0\alpha_0^3 + \frac{14}{27}d_1' y_0\alpha_0^3 - \frac{541 y_0\alpha_0^3}{108} + \frac{17 d_1\alpha_0^3}{18(y_0-2)} - \frac{d_1'\alpha_0^3}{9(y_0-2)} - \frac{29\alpha_0^3}{6(y_0-2)} + \frac{8d_1\alpha_0^3}{27(y_0-2)^2} - \frac{64\alpha_0^3}{27(y_0-2)^2} - \frac{197\alpha_0^3}{108} -$$
$$\frac{23}{54}d_1 y_0^3\alpha_0^2 - \frac29 d_1' y_0^3\alpha_0^2 + \frac{359 y_0^3\alpha_0^2}{108} + \frac{17}{12}d_1 y_0^2\alpha_0^2 + \frac23 d_1' y_0^2\alpha_0^2 - \frac{2099 y_0^2\alpha_0^2}{216} + \frac{113 d_1\alpha_0^2}{72} - \frac{13 d_1'\alpha_0^2}{36} - \frac{10}{9}d_1 y_0\alpha_0^2 -$$
$$\frac13 d_1' y_0\alpha_0^2 + \frac{215 y_0\alpha_0^2}{27} + \frac{46 d_1\alpha_0^2}{9(y_0-2)} - \frac{8d_1'\alpha_0^2}{9(y_0-2)} - \frac{25\alpha_0^2}{2(y_0-2)} + \frac{83 d_1\alpha_0^2}{18(y_0-2)^2} - \frac{d_1'\alpha_0^2}{3(y_0-2)^2} - \frac{349\alpha_0^2}{18(y_0-2)^2} + \frac{4d_1\alpha_0^2}{3(y_0-2)^3} - \frac{68\alpha_0^2}{9(y_0-2)^3} -$$
$$\frac{169\alpha_0^2}{72} + \frac{25}{27}d_1 y_0^3\alpha_0 + \frac{8}{27}d_1' y_0^3\alpha_0 - \frac{91 y_0^3\alpha_0}{18} - \frac{23}{6}d_1 y_0^2\alpha_0 - \frac{11}{9}d_1' y_0^2\alpha_0 + \frac{2099 y_0^2\alpha_0}{108} + \frac{83 d_1\alpha_0}{36} - \frac{19 d_1'\alpha_0}{18} + \frac{52 d_1 y_0\alpha_0}{9} +$$
$$\frac{14 d_1' y_0\alpha_0}{9} - \frac{949 y_0\alpha_0}{36} + \frac{383 d_1\alpha_0}{18(y_0-2)} - \frac{35 d_1'\alpha_0}{9(y_0-2)} - \frac{385\alpha_0}{18(y_0-2)} - \frac{\alpha_0}{3(y_0-1)} + \frac{151 d_1\alpha_0}{3(y_0-2)^2} - \frac{38 d_1'\alpha_0}{9(y_0-2)^2} - \frac{983\alpha_0}{9(y_0-2)^2} + \frac{118 d_1\alpha_0}{3(y_0-2)^3} -$$
$$\frac{4d_1'\alpha_0}{3(y_0-2)^3} - \frac{998\alpha_0}{9(y_0-2)^3} + \frac{32 d_1\alpha_0}{3(y_0-2)^4} - \frac{320\alpha_0}{9(y_0-2)^4} + \frac{167\alpha_0}{36} - \frac{2d_1'^2 y_0^3}{81} + \frac{31 d_1' y_0^3}{81} + \frac{\pi^2 y_0^3}{27} - \frac{230 y_0^3}{81} + \frac{17 d_1'^2 y_0^2}{108} - \frac{247 d_1' y_0^2}{108} -$$
$$\frac{\pi^2 y_0^2}{6} + \frac{247 y_0^2}{18} - \frac{49 d_1'^2 y_0}{54} + \frac{304 d_1' y_0}{27} + \frac{\pi^2 y_0}{3} - \frac{134 y_0}{3} + \Big(-\frac19 y_0^3\alpha_0^4 + \frac{y_0^2\alpha_0^4}{6} - \frac{2y_0\alpha_0^4}{3} + \frac{\alpha_0^4}{3(y_0-2)} + \frac{\alpha_0^4}{6} + \frac{16 y_0^3\alpha_0^3}{27} -$$
$$\frac{4y_0^2\alpha_0^3}{3} + \frac{16 y_0\alpha_0^3}{9} + \frac{2\alpha_0^3}{y_0-2} + \frac{8\alpha_0^3}{9(y_0-2)^2} + \frac{7\alpha_0^3}{9} - \frac{4y_0^3\alpha_0^2}{3} + 4y_0^2\alpha_0^2 - \frac{10 y_0\alpha_0^2}{3} + \frac{16\alpha_0^2}{3(y_0-2)} + \frac{22\alpha_0^2}{3(y_0-2)^2} + \frac{8\alpha_0^2}{3(y_0-2)^3} + \frac{7\alpha_0^2}{6} +$$
$$\frac{16 y_0^3\alpha_0}{9} - \frac{20 y_0^2\alpha_0}{3} + 8y_0\alpha_0 + \frac{26\alpha_0}{3(y_0-2)} + \frac{36\alpha_0}{(y_0-2)^2} + \frac{104\alpha_0}{3(y_0-2)^3} + \frac{32\alpha_0}{3(y_0-2)^4} - \alpha_0 - \frac{2d_1' y_0^3}{27} + \frac{25 y_0^3}{54} + \frac{7 d_1' y_0^2}{18} - \frac{95 y_0^2}{36} -$$
$$\frac{41 d_1}{36} - \frac{d_1'}{18} - \frac{11 d_1' y_0}{9} + 9y_0 - \frac{8 d_1'}{3(y_0-2)} + \frac{20}{3(y_0-2)} + \frac{4d_1}{3(y_0-1)} - \frac{2d_1'}{3(y_0-1)} - \frac{7}{2(y_0-1)} + \frac{16 d_1}{(y_0-2)^2} - \frac{12 d_1'}{(y_0-2)^2} - \frac{344}{3(y_0-2)^2} -$$
$$\frac{1}{3(y_0-1)^2} + \frac{128 d_1}{9(y_0-2)^3} - \frac{88 d_1'}{9(y_0-2)^3} - \frac{2152}{9(y_0-2)^3} + \frac{4d_1}{(y_0-2)^4} - \frac{8d_1'}{3(y_0-2)^4} - \frac{548}{3(y_0-2)^4} - \frac{448}{9(y_0-2)^5} + \frac{317}{36}\Big) H(0;\alpha_0) + \Big(-$$
$$\frac19 d_1 y_0^3\alpha_0^4 + \frac16 d_1 y_0^2\alpha_0^4 + \frac{d_1\alpha_0^4}{6} - \frac23 d_1 y_0\alpha_0^4 + \frac{d_1\alpha_0^4}{3(y_0-2)} + \frac{16}{27}d_1 y_0^3\alpha_0^3 - \frac43 d_1 y_0^2\alpha_0^3 + \frac{7d_1\alpha_0^3}{9} + \frac{16}{9}d_1 y_0\alpha_0^3 + \frac{2d_1\alpha_0^3}{y_0-2} +$$
$$\frac{8d_1\alpha_0^3}{9(y_0-2)^2} - \frac43 d_1 y_0^3\alpha_0^2 + 4d_1 y_0^2\alpha_0^2 + \frac{7d_1\alpha_0^2}{6} - \frac{10}{3}d_1 y_0\alpha_0^2 + \frac{16 d_1\alpha_0^2}{3(y_0-2)} + \frac{22 d_1\alpha_0^2}{3(y_0-2)^2} + \frac{8d_1\alpha_0^2}{3(y_0-2)^3} + \frac{16}{9}d_1 y_0^3\alpha_0 -$$
$$\frac{20}{3}d_1 y_0^2\alpha_0 - d_1\alpha_0 + 8d_1 y_0\alpha_0 + \frac{26 d_1\alpha_0}{3(y_0-2)} + \frac{36 d_1\alpha_0}{(y_0-2)^2} + \frac{104 d_1\alpha_0}{3(y_0-2)^3} + \frac{32 d_1\alpha_0}{3(y_0-2)^4} - \frac{25 d_1 y_0^3}{27} + \frac{23 d_1 y_0^2}{6} - \frac{10 d_1}{9} - \frac{52 d_1 y_0}{9} -$$
$$\frac{49 d_1}{3(y_0-2)} - \frac{398 d_1}{9(y_0-2)^2} - \frac{112 d_1}{3(y_0-2)^3} - \frac{32 d_1}{3(y_0-2)^4}\Big) H(1;\alpha_0) + \Big(-\frac{1}{18}y_0^3\alpha_0^4 + \frac{y_0^2\alpha_0^4}{12} - \frac{y_0\alpha_0^4}{3} + \frac{\alpha_0^4}{6(y_0-2)} + \frac{17\alpha_0^4}{36} + \frac{8y_0^3\alpha_0^3}{27} -$$
$$\frac{2y_0^2\alpha_0^3}{3} + \frac{8y_0\alpha_0^3}{9} + \frac{\alpha_0^3}{y_0-2} + \frac{4\alpha_0^3}{9(y_0-2)^2} + \frac{29\alpha_0^3}{54} - \frac{2y_0^3\alpha_0^2}{3} + 2y_0^2\alpha_0^2 - \frac{5y_0\alpha_0^2}{3} + \frac{8\alpha_0^2}{3(y_0-2)} + \frac{11\alpha_0^2}{3(y_0-2)^2} + \frac{4\alpha_0^2}{3(y_0-2)^3} + \frac{17\alpha_0^2}{12} +$$
$$\frac{8y_0^3\alpha_0}{9} - \frac{10 y_0^2\alpha_0}{3} - \frac{4d_1\alpha_0}{3} + \frac{2d_1'\alpha_0}{3} + 4y_0\alpha_0 + \frac{13\alpha_0}{3(y_0-2)} + \frac{18\alpha_0}{(y_0-2)^2} + \frac{52\alpha_0}{3(y_0-2)^3} + \frac{16\alpha_0}{3(y_0-2)^4} - \frac{19\alpha_0}{18} - \frac{25 y_0^3}{54} + \frac{61 y_0^2}{36} +$$
$$\frac{4d_1}{3} - \frac{2d_1'}{3} - 2y_0 + \Big(-\frac{4\alpha_0}{3} + \frac{4}{3(y_0-1)} + \frac43\Big) H(0;\alpha_0) + \Big(-\frac{4\alpha_0 d_1}{3} + \frac{4d_1}{3(y_0-1)} + \frac{4d_1}{3}\Big) H(1;\alpha_0) - \frac{32}{3(y_0-2)} +$$
$$\frac{4d_1}{3(y_0-1)} - \frac{2d_1'}{3(y_0-1)} - \frac{7}{2(y_0-1)} - \frac{332}{9(y_0-2)^2} - \frac{1}{3(y_0-1)^2} - \frac{104}{3(y_0-2)^3} - \frac{32}{3(y_0-2)^4} - \frac{53}{18}\Big) H(c_1(\alpha_0);y_0) + \Big(-\frac{d_1\alpha_0^4}{4} +$$
$$\frac{d_1'\alpha_0^4}{6} + \frac{25\alpha_0^4}{12} - \frac{7d_1\alpha_0^3}{9} + \frac{5d_1'\alpha_0^3}{9} + \frac{11\alpha_0^3}{9} - \frac{d_1\alpha_0^2}{6} + \frac{d_1'\alpha_0^2}{3} - \frac{13\alpha_0^2}{2} + \frac{11 d_1\alpha_0}{3} - \frac{5d_1'\alpha_0}{3} - \frac{23\alpha_0}{3} - \frac{89 d_1}{36} + \frac{11 d_1'}{18} + \Big(-\alpha_0^4 -$$
$$\frac{4\alpha_0^3}{3} + 2\alpha_0^2 + 4\alpha_0 + \frac{160}{3(y_0-2)^2} + \frac{320}{3(y_0-2)^3} + \frac{80}{(y_0-2)^4} + \frac{64}{3(y_0-2)^5} - \frac{11}{3}\Big) H(0;\alpha_0) + \Big(-d_1\alpha_0^4 - \frac{4d_1\alpha_0^3}{3} + 2d_1\alpha_0^2 +$$
$$4d_1\alpha_0 - \frac{11 d_1}{3} + \frac{160 d_1}{3(y_0-2)^2} + \frac{320 d_1}{3(y_0-2)^3} + \frac{80 d_1}{(y_0-2)^4} + \frac{64 d_1}{3(y_0-2)^5}\Big) H(1;\alpha_0) - \frac{8d_1'}{3(y_0-2)} + \frac{52}{3(y_0-2)} + \frac{16 d_1}{(y_0-2)^2} - \frac{12 d_1'}{(y_0-2)^2} -$$
$$\frac{700}{9(y_0-2)^2} + \frac{128 d_1}{9(y_0-2)^3} - \frac{88 d_1'}{9(y_0-2)^3} - \frac{1840}{9(y_0-2)^3} + \frac{4d_1}{(y_0-2)^4} - \frac{8d_1'}{3(y_0-2)^4} - \frac{172}{(y_0-2)^4} - \frac{448}{9(y_0-2)^5} + \frac{391}{36}\Big) H(c_2(\alpha_0);y_0) +$$

$$\Bigg(-\frac{4\ y_0^3}{9}+2y_0^2-4y_0+\frac{4}{3(y_0-1)}+\frac{160}{3\ (y_0-2)^2}+\frac{320}{3(y_0-2)^3}+\frac{80}{(y_0-2)^4}+\frac{64}{3(\ y_0-2)^5}-3\Bigg)H(0,0;\alpha_0)+\Bigg(-\frac{20y_0^3}{9}+10y_0^2-$$

$$20y_0-\frac{4}{y_0-1}-\frac{160}{(y_0-2)^2}-\frac{320}{(y_0-2)^3}-\frac{240}{\ }(y_0-2)^4-\frac{64}{(y_0-2)^5}+\frac{17}{9}\Bigg) H(0,0;y_0)+\Bigg(-\frac{4d_1y_0^3}{9}+2d_1y_0^2-4d_1y_0-$$

$$3\ d_1+\frac{4d_1}{3(y_0-1)}+\frac{160d_1}{3(y_0-2)^2}+\frac{320\ d_1}{3(y_0-2)^3}+\frac{80d_1}{(y_0-2)^4}+\frac{64d_1}{3(y_0-2)^5}\Bigg)H(0,1;\alpha_0)+\Bigg(-\frac{2d_1'y_0^3}{3}+3d_1'y_0^2-6d_1'\ y_0-\frac{5d_1'}{18}+$$

$$\Bigg(\frac{4d_1}{3}-\frac{4}{3}\Bigg)H(0;\alpha_0)-\frac{2d_1'}{3(y_0-1)}-\frac{80d_1'}{3(y_0-2)^2}-\frac{160\ d_1'}{3(y_0-2)^3}-\frac{40d_1'}{(y_0-2)^4}-\frac{32d_1'}{3\ (y_0-2)^5}\Bigg)H(0,1;y_0)+\Bigg(\frac{2y_0^3}{9}-y_0^2+2\ y_0-$$

$$\frac{4}{3}H(0;\alpha_0)-\frac{4}{3}d_1\ H(1;\alpha_0)+\frac{2}{y_0-1}-\frac{80}{3(y_0-2)^2}-\frac{160}{3\ (y_0-2)^3}-\frac{40}{(y_0-2)^4}-\frac{32}{3(y_0-2)^5}+\frac{107}{18}\Bigg)H(0,c_1(\alpha_0);y_0)+$$

$$\Bigg(-\frac{26}{3}+\frac{320}{3\ (y_0-2)^2}+\frac{640}{3(y_0-2)^3}+\frac{160}{(y_0-2)^4}+\frac{128}{3\ (y_0-2)^5}\Bigg)H(0,c_2(\alpha_0);y_0)+\Bigg(-\frac{2d_1'\ y_0^3}{3}-\frac{2y_0^3}{9}+3d_1'y_0^2+y_0^2-$$

$$6d_1'y_0-2\ y_0+\frac{19d_1'}{3}-\frac{4}{3}H(0;\alpha_0)+\frac{4d_1}{3\ (y_0-1)}-\frac{2d_1'}{3(y_0-1)}-\frac{2}{3(y_0-1)}-\frac{80\ d_1'}{3(y_0-2)^2}+\frac{80}{3(y_0-2)^2}-\frac{160d_1'}{3\ (y_0-2)^3}+\frac{160}{3(y_0-2)^3}-$$

$$\frac{40\ d_1'}{(y_0-2)^4}+\frac{40}{(y_0-2)^4}-\frac{32d_1'}{3\ (y_0-2)^5}+\frac{32}{3(y_0-2)^5}-\frac{107}{18}\Bigg) H(1,0;y_0)+\Bigg(-\frac{2}{9}d_1'^2y_0^3+d_1'^2y_0^2-2d_1'^2\ y_0+\frac{11d_1'^2}{9}+\Bigg(\frac{4d_1}{3}-$$

$$\frac{2\ d_1'}{3}-\frac{2}{3}\Bigg)H(0;\alpha_0)\Bigg)H(1,1;y_0)+\Bigg(\frac{2\ y_0^3}{9}-y_0^2+2y_0-\frac{4}{3}H(0;\alpha_0)-\frac{4}{3}d_1\ H(1;\alpha_0)-\frac{4d_1}{3(y_0-1)}+\frac{2d_1'}{3(y_0-1)}+$$

$$\frac{2}{3\ (y_0-1)}-\frac{80}{3(y_0-2)^2}-\frac{160}{3\ (y_0-2)^3}-\frac{40}{(y_0-2)^4}-\frac{32}{3(y_0-2)^5}+\frac{107}{18}\Bigg)H(1,c_1(\alpha_0);y_0)+\Bigg(\frac{80d_1'}{3(y_0-2)^2}+\frac{160\ d_1'}{3(y_0-2)^3}+$$

$$\frac{40d_1'}{(y_0-2)^4}+\frac{32d_1'}{3\ (y_0-2)^5}-\frac{8d_1'}{3}\Bigg)H(1,c_2(\alpha_0);y_0)+\Bigg(-\frac{160\ d_1}{3(y_0-2)^2}-\frac{320d_1}{3(y_0-2)^3}-\frac{80\ d_1}{(y_0-2)^4}-\frac{64d_1}{3(y_0-2)^5}+\frac{8\ d_1'}{3}+\frac{160}{3(y_0-2)^2}+$$

$$\frac{320}{3\ (y_0-2)^3}+\frac{80}{(y_0-2)^4}+\frac{64}{3\ (y_0-2)^5}-\frac{26}{3}\Bigg)H(2,0;y_0)+\Bigg(\frac{160d_1}{3\ (y_0-2)^2}+\frac{320d_1}{3(y_0-2)^3}+\frac{80\ d_1}{(y_0-2)^4}+\frac{64d_1}{3(y_0-2)^5}-\frac{8\ d_1'}{3}-$$

$$\frac{160}{3(y_0-2)^2}-\frac{320}{3\ (y_0-2)^3}-\frac{80}{(y_0-2)^4}-\frac{64}{3\ (y_0-2)^5}+\frac{26}{3}\Bigg)H(2,c_2(\alpha_0);y_0)+\Bigg(-\frac{4\alpha_0}{3}+\frac{4}{3(y_0-1)}+\frac{4}{3}\Bigg)H(c_1(\alpha_0),0;y_0)+$$

$$\Bigg(-\frac{2\ \alpha_0d_1'}{3}+\frac{2d_1'}{3(y_0-1)}+\frac{2d_1'}{3}\Bigg) H(c_1(\alpha_0),1;y_0)+\Bigg(-\frac{2\alpha_0}{3}+\frac{2}{3\ (y_0-1)}+\frac{2}{3}\Bigg) H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\Bigg(-\alpha_0^4-$$

$$\frac{4\alpha_0^3}{3}+2\alpha_0^2+4\alpha_0+\frac{160}{3(y_0-2)^2}+\frac{320}{3(y_0-2)^3}+\frac{80}{(y_0-2)^4}+\frac{64}{3(y_0-2)^5}-\frac{11}{3}\Bigg) H(c_2(\alpha_0),0;y_0)+\Bigg(-\frac{d_1'\alpha_0^4}{2}-\frac{2d_1'\ \alpha_0^3}{3}+$$

$$d_1'\alpha_0^2+2d_1'\alpha_0-\frac{11d_1'}{6}+\frac{80d_1'}{3\ (y_0-2)^2}+\frac{160d_1'}{3(y_0-2)^3}+\frac{40\ d_1'}{(y_0-2)^4}+\frac{32d_1'}{3(y_0-2)^5}\Bigg) H(c_2(\alpha_0),1;y_0)+\Bigg(-\frac{\alpha_0^4}{2}-\frac{2\alpha_0^3}{3}+$$

$$\alpha_0^2+2\ \alpha_0+\frac{80}{3(y_0-2)^2}+\frac{160}{3\ (y_0-2)^3}+\frac{40}{(y_0-2)^4}+\frac{32}{3\ (y_0-2)^5}-\frac{11}{6}\Bigg)H(c_2(\alpha_0),c_1(\alpha_0);y_0)+\frac{32}{3}\ H(0,0,0;y_0)+$$

$$\frac{8}{3}d_1'H(0,0,1;y_0)-\frac{8}{3}\ H(0,0,c_1(\alpha_0);y_0)+\Bigg(-\frac{4d_1}{3}+\frac{8\ d_1'}{3}+\frac{4}{3}\Bigg)H(0,1,0;y_0)+\frac{2}{3}d_1'^2\ H(0,1,1;y_0)+$$

$$\Bigg(\frac{4d_1}{3}-\frac{2d_1'}{3}-\frac{4}{3}\Bigg) H(0,1,c_1(\alpha_0);y_0)-\frac{4}{3}H(0,c_1(\alpha_0),0;y_0)-\frac{2}{3}d_1'\ H(0,c_1(\alpha_0),1;y_0)-$$

$$\frac{2}{3}H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+4H(1,0,0;\ y_0)+\frac{2}{3}d_1'H(1,0,1;y_0)-2\ H(1,0,c_1(\alpha_0);y_0)+\Bigg(-\frac{4d_1}{3}+\frac{2\ d_1'}{3}+$$

$$\frac{2}{3}\Bigg)H(1,1,0;y_0)+\Bigg(\frac{4d_1}{3}-\frac{2\ d_1'}{3}-\frac{2}{3}\Bigg)H(1,1,c_1(\alpha_0);y_0)-\frac{4}{3}\ H(1,c_1(\alpha_0),0;y_0)-\frac{2}{3}d_1'H(1,c_1(\alpha_0),1;y_0)-$$

$$\frac{2}{3}\ H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+H(0;y_0)\Bigg(-\frac{1}{9}y_0^3\ \alpha_0^4+\frac{y_0^2\alpha_0^4}{6}-\frac{2y_0\alpha_0^4}{3}+\frac{\alpha_0^4}{3\ (y_0-2)}+\frac{\alpha_0^4}{6}+\frac{16y_0^3\alpha_0^3}{27}-\frac{4y_0^2\ \alpha_0^3}{3}+\frac{16y_0\alpha_0^3}{9}+$$

$$\frac{2\alpha_0^3}{y_0-2}+\frac{8\ \alpha_0^3}{9(y_0-2)^2}+\frac{7\alpha_0^3}{9}-\frac{4y_0^3\alpha_0^2}{3}+4y_0^2\ \alpha_0^2-\frac{10y_0\alpha_0^2}{3}+\frac{16\alpha_0^2}{3(y_0-2)}+\frac{22\ \alpha_0^2}{3(y_0-2)^2}+\frac{8\alpha_0^2}{3(y_0-2)^3}+\frac{7\ \alpha_0^2}{6}+\frac{16y_0^3\alpha_0}{9}-\frac{20y_0^2\alpha_0}{3}+$$

$$8y_0\ \alpha_0+\frac{26\alpha_0}{3(y_0-2)}+\frac{36\alpha_0}{(y_0-2)^2}+\frac{104\ \alpha_0}{3(y_0-2)^3}+\frac{32\alpha_0}{3(y_0-2)^4}-\alpha_0-\frac{2d_1'\ y_0^3}{9}+\frac{175y_0^3}{54}+\frac{7d_1'y_0^2}{6}-\frac{529\ y_0^2}{36}+\frac{41d_1}{36}+\frac{d_1'}{18}-\frac{11d_1'y_0}{3}+$$

$$35\ y_0+\Bigg(-\frac{4y_0^3}{9}+2y_0^2-4y_0+\frac{4}{3\ (y_0-1)}+\frac{160}{3(y_0-2)^2}+\frac{320}{3\ (y_0-2)^3}+\frac{80}{(y_0-2)^4}+\frac{64}{3(y_0-2)^5}-3\Bigg)\ H(0;\alpha_0)+\frac{8d_1'}{3(y_0-2)}-$$

$$\frac{20}{3(y_0-2)}-\frac{4d_1}{3\ (y_0-1)}+\frac{2d_1'}{3(y_0-1)}+\frac{7}{2(y_0-1)}-\frac{16d_1}{(\ y_0-2)^2}+\frac{12d_1'}{(y_0-2)^2}+\frac{344}{3\ (y_0-2)^2}+\frac{1}{3(y_0-1)^2}-\frac{128d_1}{9(y_0-2)^3}+\frac{88\ d_1'}{9(y_0-2)^3}+$$

$$\frac{2152}{9(y_0-2)^3}-\frac{4\ d_1}{(y_0-2)^4}+\frac{8d_1'}{3(y_0-2)^4}+\frac{548}{3\ (y_0-2)^4}+\frac{448}{9(y_0-2)^5}+\frac{320\ln 2}{3\ (y_0-2)^2}+\frac{640\ln 2}{3(y_0-2)^3}+\frac{160\ln 2}{(y_0-2)^4}+\frac{128\ln 2}{3(y_0-2)^5}-\frac{26\ln 2}{3}-$$

$$\frac{535}{108}\Bigg)+H(2;y_0)\Bigg(\frac{160\ln 2\,d_1}{3\ (y_0-2)^2}+\frac{320\ln 2\,d_1}{3(y_0-2)^3}+\frac{80\ln 2\ \ d_1}{(y_0-2)^4}+\frac{64\ln 2\,d_1}{3(y_0-2)^5}+\Bigg(\frac{160\ d_1}{3(y_0-2)^2}+\frac{320d_1}{3(y_0-2)^3}+\frac{80\ d_1}{(y_0-2)^4}+\frac{64d_1}{3(y_0-2)^5}-$$

$$\frac{8\ d_1'}{3}-\frac{160}{3(y_0-2)^2}-\frac{320}{3\ (y_0-2)^3}-\frac{80}{(y_0-2)^4}-\frac{64}{3\ (y_0-2)^5}+\frac{26}{3}\Bigg)H(0;\alpha_0)-\frac{8}{3}d_1'\ln 2-\frac{160\ln 2}{3(y_0-2)^2}-\frac{320\ln 2}{3\ (y_0-2)^3}-\frac{80\ln 2}{(y_0-2)^4}-$$

$$\frac{64\ln 2}{3\ (y_0-2)^5}+\frac{26\ln 2}{3}\Bigg)+H(1;y_0)\Bigg(-\frac{1}{18}\ d_1'y_0^3\alpha_0^4+\frac{1}{12}d_1'y_0^2\alpha_0^4+\frac{17d_1'\ \alpha_0^4}{36}-\frac{1}{3}d_1'y_0\alpha_0^4+\frac{d_1'\alpha_0^4}{6\ (y_0-2)}+\frac{8}{27}d_1'y_0^3\alpha_0^3-$$

$$\frac{2}{3}d_1'y_0^2\ \alpha_0^3+\frac{d_1'\alpha_0^3}{27}+\frac{8}{9}d_1'y_0\alpha_0^3+\frac{d_1'\ \alpha_0^3}{y_0-2}+\frac{4d_1'\alpha_0^3}{9(y_0-2)^2}-\frac{2}{3}d_1'y_0^3\ \alpha_0^2+2d_1'y_0^2\alpha_0^2+\frac{2d_1'\alpha_0^2}{3}-\frac{5}{3}d_1'y_0\ \alpha_0^2+\frac{8d_1'\alpha_0^2}{3(y_0-2)}+$$

$$\frac{11d_1'\alpha_0^2}{3\ (y_0-2)^2}+\frac{4d_1'\alpha_0^2}{3(y_0-2)^3}+\frac{8}{9}d_1'y_0^3\ \alpha_0-\frac{10}{3}d_1'y_0^2\alpha_0-\frac{23d_1'\alpha_0}{9}+4d_1'y_0\alpha_0+\frac{13d_1'\alpha_0}{3(y_0-2)}+\frac{18d_1'\alpha_0}{(y_0-2)^2}+\frac{52\ d_1'\alpha_0}{3(y_0-2)^3}+\frac{16d_1'\alpha_0}{3(y_0-2)^4}- \frac{2d_1'^2\ y_0^3}{27}+\frac{25d_1'y_0^3}{27}+\frac{49d_1'^2}{54}+\frac{7\ d_1'^2y_0^2}{18}-\frac{13d_1'y_0^2}{3}-\frac{205\ d_1'}{27}-\frac{11d_1'^2y_0}{9}+11d_1'y_0+\Big(-\frac{2d_1'\ y_0^3}{9}+\frac{2y_0^3}{9}+d_1'y_0^2-y_0^2-2d_1'y_0+ 2\ y_0-\frac{13d_1'}{9}-\frac{4d_1}{3(y_0-1)}+\frac{2d_1'}{3\ (y_0-1)}+\frac{2}{3(y_0-1)}+\frac{80d_1'}{3(y_0-2)^2}-\frac{80}{3\ (y_0-2)^2}+\frac{160d_1'}{3(y_0-2)^3}-\frac{160}{3\ (y_0-2)^3}+\frac{40d_1'}{(y_0-2)^4}-\frac{40}{(y_0-2)^4}+ \frac{32\ d_1'}{3(y_0-2)^5}-\frac{32}{3(y_0-2)^5}+\frac{107}{18}\Big)\ H(0;\alpha_0)-\frac{4}{3}H(0,0;\alpha_0)-\frac{4}{3}d_1\ H(0,1;\alpha_0)-\frac{8}{3}d_1'\ln 2+\frac{80d_1'\ln 2}{3\ (y_0-2)^2}+\frac{160d_1'\ln 2}{3(y_0-2)^3}+ \frac{40d_1'\ln\ 2}{(y_0-2)^4}+\frac{32d_1'\ln 2}{3(y_0-2)^5}+\frac{\pi\ ^2}{9}\Big)-\frac{\pi^2}{9(y_0-1)}-\frac{20\pi^2}{9\ (y_0-2)^2}-\frac{40\pi^2}{9(y_0-2)^3}-\frac{10\pi^2}{3\ (y_0-2)^4}-\frac{8\pi^2}{9(y_0-2)^5}+\zeta_3-\frac{80\ln^2 2}{3(y_0-2)^2}- \frac{160\ln^2 2}{3(y_0-2)^3}-\frac{40\ln^2 2}{(y_0-2)^4}-\frac{32\ln^2 2}{3(y_0-2)^5}+\frac{13\ln^2 2}{6}-\frac{89}{36}d_1\ln 2+\frac{11}{18}d_1'\ln 2-\frac{8\ d_1'\ln 2}{3(y_0-2)}+\frac{52\ln 2}{3(y_0-2)}+\frac{16d_1\ \ln 2}{(y_0-2)^2}-\frac{12d_1'\ln 2}{(y_0-2)^2}- \frac{700\ln\ 2}{9(y_0-2)^2}+\frac{128d_1\ln 2}{9(y_0-2)^3}-\frac{88d_1'\ \ln 2}{9(y_0-2)^3}-\frac{1840\ln 2}{9(y_0-2)^3}+\frac{4d_1\ \ln 2}{(y_0-2)^4}-\frac{8d_1'\ln 2}{3(y_0-2)^4}-\frac{172\ \ln 2}{(y_0-2)^4}-\frac{448\ln 2}{9(y_0-2)^5}+\frac{47\ln\ 2}{4}+\frac{5\pi^2}{72}-\frac{160}{81}.$$

G.4 The $\mathcal{K}\!*\!\mathcal{I}$ integral for $k=-1$

The ε expansion for this integral reads

$$\mathcal{K}\!*\!\mathcal{I}(\epsilon;y_0,d_0',\alpha_0,d_0;1)=\frac{1}{\varepsilon^4}(k*i)_{-4}^{(-1)}+\frac{1}{\varepsilon^3}(k*i)_{-3}^{(-1)}+\frac{1}{\varepsilon^2}(k*i)_{-2}^{(-1)}+\frac{1}{\varepsilon}(k*i)_{-1}^{(-1)}+(k*i)_0^{(-1)}+\mathcal{O}(\varepsilon)\,, \tag{G.4}$$

where

$$(k*i)_{-4}^{(-1)}=\tfrac{1}{4},$$

$$(k*i)_{-3}^{(-1)}=\tfrac{y_0^3}{3}-\tfrac{3y_0^2}{2}+3y_0-H(0;y_0),$$

$$(k*i)_{-2}^{(-1)}=-\tfrac{d_1'y_0^3}{9}+\tfrac{7y_0^3}{9}+\tfrac{7d_1'y_0^2}{12}-4\ y_0^2-\tfrac{11d_1'y_0}{6}+13y_0+\Big(-\tfrac{4y_0^3}{3}+6y_0^2-12\ y_0\Big)H(0;y_0)+ \Big(-\tfrac{d_1'y_0^3}{3}+\tfrac{3d_1'y_0^2}{2}-3\ d_1'y_0+\tfrac{11d_1'}{6}\Big)H(1;y_0)+4H(0,0;y_0)+d_1'H(0,1;y_0),$$

$$(k*i)_{-1}^{(-1)}=-\tfrac{1}{18}y_0^3\alpha_0^4+\tfrac{5y_0^2\alpha_0^4}{12}-\tfrac{5y_0\ \alpha_0^4}{3}+\tfrac{13y_0^3\alpha_0^3}{54}-\tfrac{17y_0^2\alpha_0^3}{9}+\tfrac{80\ y_0\alpha_0^3}{9}-\tfrac{11y_0^3\alpha_0^2}{36}+\tfrac{109y_0^2\ \alpha_0^2}{36}- \tfrac{158y_0\alpha_0^2}{9}-\tfrac{7y_0^3\alpha_0}{18}-\tfrac{7\ y_0^2\alpha_0}{18}+\tfrac{43y_0\alpha_0}{3}+\tfrac{d_1'^2y_0^3}{27}-\tfrac{11\ d_1'y_0^3}{27}-\tfrac{\pi^2y_0^3}{9}+\tfrac{44y_0^3}{27}-\tfrac{17\ d_1'^2y_0^2}{72}+\tfrac{25d_1'y_0^2}{9}+\tfrac{\pi^2\ y_0^2}{2}-\tfrac{37y_0^2}{4}+ \tfrac{49d_1'^2y_0}{36}-\tfrac{154d_1'\ y_0}{9}-\pi^2y_0+48y_0+\Big(\tfrac{7y_0^3}{6}-\tfrac{13\ y_0^2}{3}+\tfrac{11y_0}{2}-\tfrac{13}{6(y_0-1)}-\tfrac{13}{6}\Big)\ H(0;\alpha_0)+\Big(\tfrac{4d_1'y_0^3}{9}-\tfrac{77y_0^3}{18}- \tfrac{7d_1'\ y_0^2}{3}+\tfrac{61y_0^2}{3}+\tfrac{22d_1'y_0}{3}-\tfrac{115y_0}{2}+\tfrac{13}{6(y_0-1)}+\tfrac{13}{6}\Big)H(0;y_0)+\Big(\tfrac{d_1'^2\ y_0^3}{9}-\tfrac{7d_1'y_0^3}{9}-\tfrac{7d_1'^2y_0^2}{12}+4d_1'\ y_0^2+\tfrac{11d_1'^2y_0}{6}- 13d_1'y_0-\tfrac{49\ d_1'^2}{36}+\tfrac{88d_1'}{9}+\Big(-\tfrac{2y_0^3}{3}+3y_0^2-6\ y_0-\tfrac{2}{y_0-1}+\tfrac{19}{3}\Big)H(0;\alpha_0)-\tfrac{\pi^2}{3}\Big)\ H(1;y_0)+\Big(\tfrac{y_0^3\alpha_0^4}{6}- y_0^2\alpha_0^4+\tfrac{5y_0\ \alpha_0^4}{2}-\tfrac{5\alpha_0^4}{3}-\tfrac{8y_0^3\alpha_0^3}{9}+5y_0^2\ \alpha_0^3-\tfrac{38y_0\alpha_0^3}{3}+\tfrac{68\alpha_0^3}{9}+2y_0^3\ \alpha_0^2-\tfrac{21y_0^2\alpha_0^2}{2}+26y_0\alpha_0^2-\tfrac{38\ \alpha_0^2}{3}-\tfrac{8y_0^3\alpha_0}{3}+ 13y_0^2\alpha_0-30y_0\alpha_0+\tfrac{41\ \alpha_0}{3}+\tfrac{25y_0^3}{18}-\tfrac{35y_0^2}{6}+\tfrac{23\ y_0}{2}-\tfrac{13}{6(y_0-1)}-\tfrac{13}{6}\Big)\ H(c_1(\alpha_0);y_0)+\Big(\tfrac{16y_0^3}{3}-24y_0^2+ 48y_0\Big)\ H(0,0;y_0)+\Big(\tfrac{4d_1'y_0^3}{3}-6d_1'y_0^2+12d_1'y_0+4\ H(0;\alpha_0)\Big)H(0,1;y_0)+\Big(-\alpha_0^4+\tfrac{16\alpha_0^3}{3}-12\alpha_0^2+ 16\ \alpha_0-\tfrac{2y_0^3}{3}+3y_0^2-6y_0-\tfrac{2}{y_0-1}-2\Big)\ H(0,c_1(\alpha_0);y_0)+\Big(\tfrac{4d_1'y_0^3}{3}+\tfrac{2y_0^3}{3}-6\ d_1'y_0^2-3y_0^2+12d_1'y_0+ 6y_0-\tfrac{22\ d_1'}{3}+\tfrac{2}{y_0-1}-\tfrac{19}{3}\Big)\ H(1,0;y_0)+\Big(\tfrac{d_1'^2y_0^3}{3}-\tfrac{3d_1'^2y_0^2}{2}+3\ d_1'^2y_0-\tfrac{11d_1'^2}{6}+2H(0;\alpha_0)\Big)\ H(1,1;y_0)+ \Big(-\tfrac{2y_0^3}{3}+3y_0^2-6\ y_0-\tfrac{2}{y_0-1}+\tfrac{19}{3}\Big)H(1,c_1(\alpha_0);y_0)+\Big(-2\ \alpha_0+\tfrac{2}{y_0-1}+2\Big)H(c_1(\alpha_0),c_1(\alpha_0);y_0)- 16H(0,0,0;y_0)-4\ d_1'H(0,0,1;y_0)+4H(0,0,c_1(\alpha_0);y_0)+(-4d_1'-4)\ H(0,1,0;y_0)- d_1'^2H(0,1,1;y_0)+4H(0,1,c_1(\alpha_0);y_0)-2\ H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+2H(1,0,c_1(\alpha_0);y_0)- 2H(1,1,0;y_0)+2\ H(1,1,c_1(\alpha_0);y_0)-2H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\tfrac{\pi^2}{3\ (y_0-1)}-\tfrac{3\zeta_3}{2}+\tfrac{\pi^2}{3},$$

$$(k*i)_0^{(-1)} = \frac{1}{36}d_1y_0^3\alpha_0^4+\frac{1}{27}d_1'y_0^3\alpha_0^4-\frac{19\ y_0^3\alpha_0^4}{108}-\frac{5}{24}d_1y_0^2\alpha_0^4-\frac{13}{36}d_1'\ y_0^2\alpha_0^4+\frac{35y_0^2\alpha_0^4}{24}+\frac{5}{6}d_1y_0\ \alpha_0^4+$$

$$\frac{47}{18}d_1'y_0\alpha_0^4-\frac{17y_0\ \alpha_0^4}{2}-\frac{31}{324}d_1y_0^3\alpha_0^3-\frac{29}{162}d_1'y_0^3\ \alpha_0^3+\frac{263y_0^3\alpha_0^3}{324}+\frac{91}{108}d_1y_0^2\ \alpha_0^3+\frac{187}{108}d_1'y_0^2\alpha_0^3-\frac{193y_0^2\ \alpha_0^3}{27}-$$

$$\frac{245}{54}d_1y_0\alpha_0^3-\frac{1549}{108}d_1'y_0\ \alpha_0^3+\frac{1354y_0\alpha_0^3}{27}-\frac{17}{216}d_1y_0^3\ \alpha_0^2+\frac{35}{108}d_1'y_0^3\alpha_0^2-\frac{245y_0^3\ \alpha_0^2}{216}-\frac{17}{27}d_1y_0^2\alpha_0^2-\frac{707}{216}d_1'y_0^2\ \alpha_0^2+$$

$$\frac{2803y_0^2\alpha_0^2}{216}+\frac{895}{108}d_1y_0\ \alpha_0^2+\frac{809}{27}d_1'y_0\alpha_0^2-\frac{3013y_0\ \alpha_0^2}{27}+\frac{205}{108}d_1y_0^3\alpha_0-\frac{1}{6}d_1'y_0^3\ \alpha_0-\frac{58y_0^3\alpha_0}{27}-\frac{659}{108}d_1y_0^2\ \alpha_0+$$

$$\frac{74}{27}d_1'y_0^2\alpha_0-\frac{55y_0^2\alpha_0}{27}-\frac{d_1\ y_0\alpha_0}{36}-\frac{278d_1'y_0\alpha_0}{9}+\frac{1379y_0\ \alpha_0}{12}-\frac{7\alpha_0}{12(y_0-1)}-\frac{7\alpha_0}{12}-\frac{d_1'^3\ y_0^3}{81}+\frac{5d_1'^2y_0^3}{27}-\frac{28d_1'\ y_0^3}{27}+\frac{1}{27}d_1'\pi^2y_0^3-$$

$$\frac{49\pi^2\ y_0^3}{108}+\frac{268y_0^3}{81}+\frac{43d_1'^3\ y_0^2}{432}-\frac{179d_1'^2y_0^2}{108}+\frac{1891d_1'y_0^2}{216}-\frac{7}{36}d_1'\pi^2y_0^2+\frac{37\pi^2y_0^2}{18}-\frac{161\ y_0^2}{8}-\frac{251d_1'^3y_0}{216}+\frac{545d_1'^2\ y_0}{27}-$$

$$\frac{10847d_1'y_0}{108}+\frac{11}{18}d_1'\pi^2\ y_0-\frac{21\pi^2y_0}{4}+164y_0+\Big(\frac{y_0^3\ \alpha_0^4}{9}-\frac{5y_0^2\alpha_0^4}{6}+\frac{10y_0\alpha_0^4}{3}-\frac{13\ y_0^3\alpha_0^3}{27}+\frac{34y_0^2\alpha_0^3}{9}-\frac{160y_0\ \alpha_0^3}{9}+\frac{11y_0^3\alpha_0^2}{18}-$$

$$\frac{109y_0^2\ \alpha_0^2}{18}+\frac{316y_0\alpha_0^2}{9}+\frac{7y_0^3\alpha_0}{9}+\frac{7\ y_0^2\alpha_0}{9}-\frac{86y_0\alpha_0}{3}-\frac{205d_1y_0^3}{108}-\frac{17\ d_1'y_0^3}{54}+\frac{91y_0^3}{18}+\frac{22d_1y_0^2}{3}+\frac{10\ d_1'y_0^2}{9}-\frac{187y_0^2}{9}+\frac{217d_1}{36}-$$

$$\frac{d_1'}{6}-\frac{469d_1y_0}{36}+\frac{7d_1'y_0}{18}+\frac{314\ y_0}{9}+\frac{217d_1}{36(y_0-1)}-\frac{d_1'}{6(y_0-1)}-\frac{88}{9\ (y_0-1)}-\frac{19}{12(y_0-1)^2}-\frac{295}{36}\Big)\ H(0;\alpha_0)+\Big(\frac{1}{9}d_1y_0^3\alpha_0^4-$$

$$\frac{5}{6}d_1y_0^2\ \alpha_0^4+\frac{10}{3}d_1y_0\alpha_0^4-\frac{13}{27}d_1y_0^3\ \alpha_0^3+\frac{34}{9}d_1y_0^2\alpha_0^3-\frac{160}{9}d_1y_0\ \alpha_0^3+\frac{11}{18}d_1y_0^3\alpha_0^2-\frac{109}{18}d_1y_0^2\ \alpha_0^2+\frac{316}{9}d_1y_0\alpha_0^2+$$

$$\frac{7}{9}d_1y_0^3\ \alpha_0+\frac{7}{9}d_1y_0^2\alpha_0-\frac{86d_1y_0\alpha_0}{3}-\frac{55d_1\ y_0^3}{54}+\frac{7d_1y_0^2}{3}+8d_1y_0\Big)\ H(1;\alpha_0)+\Big(-\frac{1}{12}d_1y_0^3\alpha_0^4-\frac{1}{18}d_1'y_0^3\ \alpha_0^4+\frac{5y_0^3\alpha_0^4}{12}+$$

$$\frac{1}{2}d_1y_0^2\ \alpha_0^4+\frac{5}{12}d_1'y_0^2\alpha_0^4-\frac{5y_0^2\alpha_0^4}{2}+\frac{5\ d_1\alpha_0^4}{6}+\frac{47d_1'\alpha_0^4}{36}-\frac{5}{4}d_1y_0\ \alpha_0^4-\frac{5}{3}d_1'y_0\alpha_0^4+\frac{29y_0\alpha_0^4}{4}-\frac{31\ \alpha_0^4}{6}+\frac{13}{27}d_1y_0^3\alpha_0^3+$$

$$\frac{8}{27}d_1'y_0^3\ \alpha_0^3-\frac{125y_0^3\alpha_0^3}{54}-\frac{8}{3}d_1y_0^2\ \alpha_0^3-\frac{37}{18}d_1'y_0^2\alpha_0^3+\frac{40y_0^2\ \alpha_0^3}{3}-\frac{221d_1\alpha_0^3}{54}-\frac{313d_1'\ \alpha_0^3}{54}+\frac{61}{9}d_1y_0\alpha_0^3+\frac{77}{9}d_1'y_0\ \alpha_0^3-$$

$$\frac{379y_0\alpha_0^3}{9}+\frac{745\alpha_0^3}{27}-\frac{23}{18}d_1\ y_0^3\alpha_0^2-\frac{2}{3}d_1'y_0^3\alpha_0^2+\frac{203y_0^3\ \alpha_0^2}{36}+\frac{13}{2}d_1y_0^2\alpha_0^2+\frac{17}{4}d_1'y_0^2\ \alpha_0^2-\frac{373y_0^2\alpha_0^2}{12}+\frac{287d_1\alpha_0^2}{36}+$$

$$\frac{28\ d_1'\alpha_0^2}{3}-\frac{95}{6}d_1y_0\alpha_0^2-\frac{35}{2}d_1'y_0\ \alpha_0^2+\frac{599y_0\alpha_0^2}{6}-\frac{161\alpha_0^2}{3}+\frac{25}{9}d_1\ y_0^3\alpha_0+\frac{8}{9}d_1'y_0^3\alpha_0-\frac{169y_0^3\alpha_0}{18}-13d_1\ y_0^2\alpha_0-$$

$$\frac{31}{6}d_1'y_0^2\alpha_0+\frac{295y_0^2\ \alpha_0}{6}-\frac{343d_1\alpha_0}{18}-\frac{47d_1'\alpha_0}{6}+\frac{85d_1y_0\ \alpha_0}{3}+\frac{59d_1'y_0\alpha_0}{3}-\frac{440y_0\ \alpha_0}{3}+\frac{\alpha_0}{y_0-1}+\frac{149\alpha_0}{2}-\frac{205d_1\ y_0^3}{108}-$$

$$\frac{25d_1'y_0^3}{54}+\frac{305y_0^3}{54}+\frac{22\ d_1y_0^2}{3}+\frac{7d_1'y_0^2}{3}-\frac{919y_0^2}{36}+\frac{217\ d_1}{36}-\frac{d_1'}{6}-\frac{469d_1y_0}{36}-8d_1'y_0+\frac{602\ y_0}{9}+\Big(-\frac{1}{3}y_0^3\alpha_0^4+2y_0^2\alpha_0^4-$$

$$5y_0\ \alpha_0^4+\frac{10\alpha_0^4}{3}+\frac{16y_0^3\alpha_0^3}{9}-10y_0^2\ \alpha_0^3+\frac{76y_0\alpha_0^3}{3}-\frac{136\alpha_0^3}{9}-4y_0^3\alpha_0^2+21\ y_0^2\alpha_0^2-52y_0\alpha_0^2+\frac{76\alpha_0^2}{3}+\frac{16y_0^3\alpha_0}{3}-26\ y_0^2\alpha_0+$$

$$60y_0\alpha_0-\frac{82\alpha_0}{3}-\frac{25y_0^3}{9}+\frac{35\ y_0^2}{3}-23y_0+\frac{13}{3(y_0-1)}+\frac{13}{3}\Big)\ H(0;\alpha_0)+\Big(-\frac{1}{3}d_1y_0^3\alpha_0^4+2d_1y_0^2\alpha_0^4+\frac{10\ d_1\alpha_0^4}{3}-$$

$$5d_1y_0\alpha_0^4+\frac{16}{9}d_1y_0^3\alpha_0^3-10d_1\ y_0^2\alpha_0^3-\frac{136d_1\alpha_0^3}{9}+\frac{76}{3}d_1y_0\alpha_0^3-4d_1\ y_0^3\alpha_0^2+21d_1y_0^2\alpha_0^2+\frac{76d_1\alpha_0^2}{3}-52d_1y_0\ \alpha_0^2+$$

$$\frac{16}{3}d_1y_0^3\alpha_0-26d_1y_0^2\alpha_0-\frac{82d_1\ \alpha_0}{3}+60d_1y_0\alpha_0-\frac{25d_1y_0^3}{9}+\frac{35d_1y_0^2}{3}+\frac{13d_1}{3}-23d_1y_0+\frac{13d_1}{3(y_0-1)}\Big)\ H(1;\alpha_0)+$$

$$\frac{217d_1}{36(y_0-1)}-\frac{d_1'}{6\ (y_0-1)}-\frac{88}{9(y_0-1)}-\frac{19}{12\ (y_0-1)^2}-\frac{295}{36}\Big)H(c_1(\alpha_0);y_0)+\Big(-\frac{7\ y_0^3}{3}+\frac{26y_0^2}{3}-11y_0+\frac{13}{3(y_0-1)}+$$

$$\frac{13}{3}\ \Big)H(0,0;\alpha_0)+\Big(-\frac{16d_1'y_0^3}{9}+\frac{175\ y_0^3}{9}+\frac{28d_1'y_0^2}{3}-90y_0^2-\frac{88d_1'y_0}{3}+241\ y_0-\frac{13}{y_0-1}-13\Big)H(0,0;y_0)+\Big(-$$

$$\frac{7d_1\ y_0^3}{3}+\frac{26d_1y_0^2}{3}-11d_1y_0+\frac{13d_1}{3}+\frac{13\ d_1}{3(y_0-1)}\Big)H(0,1;\alpha_0)+\Big(-\frac{4}{9}d_1'^2\ y_0^3+\frac{77d_1'y_0^3}{18}+\frac{7d_1'^2y_0^2}{3}-\frac{61d_1'\ y_0^2}{3}-\frac{22d_1'^2y_0}{3}+$$

$$\frac{115d_1'y_0}{2}-\frac{13\ d_1'}{6}+\Big(-\frac{4d_1y_0^3}{3}+\frac{4y_0^3}{3}+6d_1y_0^2-6\ y_0^2-12d_1y_0+12y_0+\frac{38d_1}{3}-\frac{4\ d_1}{y_0-1}+\frac{4}{y_0-1}+\frac{62}{3}\Big)H(0;\alpha_0)-$$

$$8H(0,0;\alpha_0)-8\ d_1H(0,1;\alpha_0)-\frac{13d_1'}{6(y_0-1)}-\frac{2d_1\pi^2}{3}\Big)\ H(0,1;y_0)+\Big(\frac{d_1\alpha_0^4}{2}-\frac{\alpha_0^4}{2}-\frac{26d_1\ \alpha_0^3}{9}+\frac{38\alpha_0^3}{9}+\frac{23d_1\alpha_0^2}{3}-$$

$$\frac{49\ \alpha_0^2}{3}-\frac{50d_1\alpha_0}{3}+\frac{142\alpha_0}{3}+\frac{2d_1'\ y_0^3}{9}-\frac{49y_0^3}{18}-\frac{7d_1'y_0^2}{6}+\frac{37\ y_0^2}{3}+4d_1-2d_1'+\frac{11d_1'y_0}{3}-\frac{63y_0}{2}+\Big(2\ \alpha_0^4-\frac{32\alpha_0^3}{3}+$$

$$24\alpha_0^2-32\alpha_0+\frac{4y_0^3}{3}-6y_0^2+12\ y_0+\frac{4}{y_0-1}+4\Big)H(0;\alpha_0)+\Big(2d_1\alpha_0^4-\frac{32d_1\ \alpha_0^3}{3}+24d_1\alpha_0^2-32d_1\alpha_0+\frac{4d_1y_0^3}{3}-$$

$$6d_1y_0^2+4\ d_1+12d_1y_0+\frac{4d_1}{y_0-1}\Big)H(1;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}-\frac{11}{6\ (y_0-1)}-\frac{1}{(y_0-1)^2}-\frac{5}{6}\Big)\ H(0,c_1(\alpha_0);y_0)+\Big(-$$

$$\frac{4}{9}d_1'^2y_0^3+\frac{73d_1'\ y_0^3}{18}+\frac{49y_0^3}{18}+\frac{7d_1'^2y_0^2}{3}-\frac{4d_1\ y_0^2}{3}-\frac{115d_1'y_0^2}{6}-\frac{41y_0^2}{3}-\frac{22d_1'^2\ y_0}{3}+\frac{16d_1y_0}{3}+\frac{323d_1'y_0}{6}+\frac{221\ y_0}{6}+\frac{49d_1'^2}{9}-$$

$$\frac{37d_1}{18}-\frac{697\ d_1'}{18}+\Big(\frac{4y_0^3}{3}-6y_0^2+12\ y_0+\frac{4}{y_0-1}-\frac{38}{3}\Big)H(0;\alpha_0)+\frac{d_1}{3(y_0-1)}-\frac{d_1'}{6(y_0-1)}+\frac{37}{6\ (y_0-1)}+\frac{1}{(y_0-1)^2}+\frac{4\pi^2}{3}-$$

$$\frac{130}{3}\Big)\ H(1,0;y_0)+\Big(-\frac{1}{9}y_0^3d_1'^3+\frac{7y_0^2\ d_1'^3}{12}-\frac{11y_0d_1'^3}{6}+\frac{49d_1'^3}{36}+\frac{7\ y_0^3d_1'^2}{9}-4y_0^2d_1'^2+13y_0d_1'^2-\frac{88\ d_1'^2}{9}+\frac{\pi^2d_1'}{3}+\Big(-$$

$$\frac{4d_1y_0^3}{3}+\frac{4\ d_1'y_0^3}{3}-\frac{2y_0^3}{3}+6d_1y_0^2-6d_1'y_0^2+3y_0^2-12\ d_1y_0+12d_1'y_0-6y_0+\frac{38d_1}{3}-10d_1'-\frac{8\ d_1}{y_0-1}+\frac{4d_1'}{y_0-1}+\frac{2}{y_0-1}+$$

$$\frac{43}{3}\bigg) H(0;\alpha_0)-4H(0,0;\alpha_0)-4d_1H(0,1;\alpha_0)-\frac{2d_1\pi^2}{3}+\frac{\pi^2}{3}\bigg)H(1,1;y_0)+\bigg(-\frac{1}{6}d_1'y_0^3\alpha_0^4+d_1'y_0^2\alpha_0^4+$$

$$\frac{5d_1'\alpha_0^4}{3}-\frac{5}{2}d_1'y_0\alpha_0^4+\frac{8}{9}d_1'y_0^3\alpha_0^3-5d_1'y_0^2\alpha_0^3-\frac{77d_1'\alpha_0^3}{9}+\frac{38}{3}d_1'y_0\alpha_0^3-2d_1'y_0^3\alpha_0^2+\frac{21}{2}d_1'y_0^2\alpha_0^2+\frac{35d_1'\alpha_0^2}{2}-$$

$$26d_1'y_0\alpha_0^2+\frac{8}{3}d_1'y_0^3\alpha_0-13d_1'y_0^2\alpha_0-\frac{65d_1'\alpha_0}{3}+30d_1'y_0\alpha_0-\frac{7d_1'y_0^3}{6}-\frac{49y_0^3}{18}+\frac{4d_1y_0^2}{3}+\frac{14d_1'y_0^2}{3}+\frac{41y_0^2}{3}+$$

$$\frac{37d_1}{18}+\frac{13d_1'}{3}-\frac{16d_1y_0}{3}-\frac{47d_1'y_0}{6}-\frac{221y_0}{6}+\bigg(\frac{4y_0^3}{3}-6y_0^2+12y_0+\frac{4}{y_0-1}-\frac{38}{3}\bigg)H(0;\alpha_0)+\bigg(\frac{4d_1y_0^3}{3}-6d_1y_0^2+$$

$$12d_1y_0-\frac{38d_1}{3}+\frac{4d_1}{y_0-1}\bigg)H(1;\alpha_0)-\frac{d_1}{3(y_0-1)}+\frac{d_1'}{6(y_0-1)}-\frac{37}{6(y_0-1)}-\frac{1}{(y_0-1)^2}+\frac{130}{3}\bigg)H(1,c_1(\alpha_0);y_0)+$$

$$\bigg(-\frac{1}{3}y_0^3\alpha_0^4+2y_0^2\alpha_0^4-5y_0\alpha_0^4+\frac{10\alpha_0^4}{3}+\frac{16y_0^3\alpha_0^3}{9}-10y_0^2\alpha_0^3+\frac{76y_0\alpha_0^3}{3}-\frac{136\alpha_0^3}{9}-4y_0^3\alpha_0^2+21y_0^2\alpha_0^2-52y_0\alpha_0^2+$$

$$\frac{76\alpha_0^2}{3}+\frac{16y_0^3\alpha_0}{3}-26y_0^2\alpha_0+60y_0\alpha_0-\frac{82\alpha_0}{3}-\frac{25y_0^3}{9}+\frac{35y_0^2}{3}-23y_0+\frac{13}{3(y_0-1)}+\frac{13}{3}\bigg)H(c_1(\alpha_0),0;y_0)+$$

$$\bigg(-\frac{1}{6}d_1'y_0^3\alpha_0^4+d_1'y_0^2\alpha_0^4+\frac{5d_1'\alpha_0^4}{3}-\frac{5}{2}d_1'y_0\alpha_0^4+\frac{8}{9}d_1'y_0^3\alpha_0^3-5d_1'y_0^2\alpha_0^3-\frac{68d_1'\alpha_0^3}{9}+\frac{38}{3}d_1'y_0\alpha_0^3-2d_1'y_0^3\alpha_0^2+$$

$$\frac{21}{2}d_1'y_0^2\alpha_0^2+\frac{38d_1'\alpha_0^2}{3}-26d_1'y_0\alpha_0^2+\frac{8}{3}d_1'y_0^3\alpha_0-13d_1'y_0^2\alpha_0-\frac{41d_1'\alpha_0}{3}+30d_1'y_0\alpha_0-\frac{25d_1'y_0^3}{18}+\frac{35d_1'y_0^2}{6}+\frac{13d_1'}{6}-$$

$$\frac{23d_1'y_0}{2}+\frac{13d_1'}{6(y_0-1)}\bigg)H(c_1(\alpha_0),1;y_0)+\bigg(-\frac{1}{2}y_0^3\alpha_0^4+3y_0^2\alpha_0^4-\frac{15y_0\alpha_0^4}{2}+5\alpha_0^4+\frac{8y_0^3\alpha_0^3}{3}-15y_0^2\alpha_0^3+38y_0\alpha_0^3-$$

$$\frac{68\alpha_0^3}{3}-6y_0^3\alpha_0^2+\frac{63y_0^2\alpha_0^2}{2}-78y_0\alpha_0^2+37\alpha_0^2+8y_0^3\alpha_0-39y_0^2\alpha_0+4d_1\alpha_0-2d_1'\alpha_0+90y_0\alpha_0-43\alpha_0-\frac{25y_0^3}{6}+$$

$$\frac{35y_0^2}{2}-4d_1+2d_1'-\frac{69y_0}{2}+\bigg(4\alpha_0-\frac{4}{y_0-1}-4\bigg)H(0;\alpha_0)+\bigg(4\alpha_0d_1-\frac{4d_1}{y_0-1}-4d_1\bigg)H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+$$

$$\frac{21}{2(y_0-1)}+\frac{1}{(y_0-1)^2}+\frac{19}{2}\bigg)H(c_1(\alpha_0),c_1(\alpha_0);y_0)+\bigg(-\frac{64y_0^3}{3}+96y_0^2-192y_0\bigg)H(0,0,0;y_0)+\bigg(-\frac{16d_1'y_0^3}{3}+$$

$$24d_1'y_0^2-48d_1'y_0+(8d_1-8)H(0;\alpha_0)\bigg)H(0,0,1;y_0)+\bigg(\frac{8y_0^3}{3}-12y_0^2+24y_0-8H(0;\alpha_0)-8d_1H(1;\alpha_0)+$$

$$\frac{8}{y_0-1}+8\bigg)H(0,0,c_1(\alpha_0);y_0)+\bigg(\frac{4d_1y_0^3}{3}-\frac{16d_1'y_0^3}{3}-\frac{4y_0^3}{3}-6d_1y_0^2+24d_1'y_0^2+6y_0^2+12d_1y_0-48d_1'y_0-$$

$$12y_0-\frac{38d_1}{3}-8H(0;\alpha_0)+\frac{4d_1}{y_0-1}-\frac{4}{y_0-1}-\frac{62}{3}\bigg)H(0,1,0;y_0)+\bigg(-\frac{4}{3}d_1'^2y_0^3+6d_1'^2y_0^2-12d_1'^2y_0+(12d_1-$$

$$8d_1')H(0;\alpha_0)\bigg)H(0,1,1;y_0)+\bigg(d_1'\alpha_0^4-\frac{16d_1'\alpha_0^3}{3}+12d_1'\alpha_0^2-16d_1'\alpha_0-\frac{4d_1y_0^3}{3}+\frac{2d_1'y_0^3}{3}+\frac{4y_0^3}{3}+6d_1y_0^2-$$

$$3d_1'y_0^2-6y_0^2+\frac{38d_1}{3}+2d_1'-12d_1y_0+6d_1'y_0+12y_0-8H(0;\alpha_0)-8d_1H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{4}{y_0-1}+$$

$$\frac{62}{3}\bigg)H(0,1,c_1(\alpha_0);y_0)+\bigg(2\alpha_0^4-\frac{32\alpha_0^3}{3}+24\alpha_0^2-32\alpha_0+\frac{4y_0^3}{3}-6y_0^2+12y_0+\frac{4}{y_0-1}+4\bigg)H(0,c_1(\alpha_0),0;y_0)+$$

$$\bigg(d_1'\alpha_0^4-\frac{16d_1'\alpha_0^3}{3}+12d_1'\alpha_0^2-16d_1'\alpha_0+\frac{2d_1'y_0^3}{3}-3d_1'y_0^2+2d_1'+6d_1'y_0+\frac{2d_1'}{y_0-1}\bigg)H(0,c_1(\alpha_0),1;y_0)+\bigg(3\alpha_0^4-$$

$$16\alpha_0^3+36\alpha_0^2-48\alpha_0+2y_0^3-9y_0^2+18y_0+4H(0;\alpha_0)+4d_1H(1;\alpha_0)-\frac{2}{y_0-1}-2\bigg)H(0,c_1(\alpha_0),c_1(\alpha_0);y_0)+$$

$$\bigg(-\frac{16d_1'y_0^3}{3}-4y_0^3+24d_1'y_0^2+18y_0^2-48d_1'y_0-36y_0+\frac{88d_1'}{3}-\frac{12}{y_0-1}+38\bigg)H(1,0,0;y_0)+\bigg(-\frac{4}{3}d_1'^2y_0^3-$$

$$\frac{2d_1'y_0^3}{3}+6d_1'^2y_0^2+3d_1'y_0^2-12d_1'^2y_0-6d_1'y_0+\frac{22d_1'^2}{3}+\frac{19d_1'}{3}+(4d_1-4)H(0;\alpha_0)-\frac{2d_1'}{y_0-1}\bigg)H(1,0,1;y_0)+$$

$$\bigg(\frac{2d_1'y_0^3}{3}+\frac{2y_0^3}{3}-3d_1'y_0^2-3y_0^2+6d_1'y_0+6y_0-\frac{11d_1'}{3}-4H(0;\alpha_0)-4d_1H(1;\alpha_0)-\frac{4d_1}{y_0-1}+\frac{2d_1'}{y_0-1}+\frac{6}{y_0-1}+$$

$$\frac{5}{3}\bigg)H(1,0,c_1(\alpha_0);y_0)+\bigg(-\frac{4}{3}d_1'^2y_0^3+\frac{4d_1y_0^3}{3}-\frac{4d_1'y_0^3}{3}+\frac{2y_0^3}{3}+6d_1'^2y_0^2-6d_1y_0^2+6d_1'y_0^2-3y_0^2-12d_1'^2y_0+$$

$$12d_1y_0-12d_1'y_0+6y_0+\frac{22d_1'^2}{3}-\frac{38d_1}{3}+10d_1'-4H(0;\alpha_0)+\frac{8d_1}{y_0-1}-\frac{4d_1'}{y_0-1}-\frac{2}{y_0-1}-\frac{43}{3}\bigg)H(1,1,0;y_0)+$$

$$\bigg(-\frac{1}{3}y_0^3d_1'^3+\frac{3y_0^2d_1'^3}{2}-3y_0d_1'^3+\frac{11d_1'^3}{6}+(8d_1-4d_1'-2)H(0;\alpha_0)\bigg)H(1,1,1;y_0)+\bigg(-\frac{4d_1y_0^3}{3}+\frac{4d_1'y_0^3}{3}-$$

$$\frac{2y_0^3}{3}+6d_1y_0^2-6d_1'y_0^2+3y_0^2-12d_1y_0+12d_1'y_0-6y_0+\frac{38d_1}{3}-10d_1'-4H(0;\alpha_0)-4d_1H(1;\alpha_0)-\frac{8d_1}{y_0-1}+$$

$$\frac{4d_1'}{y_0-1}+\frac{2}{y_0-1}+\frac{43}{3}\bigg)H(1,1,c_1(\alpha_0);y_0)+\bigg(\frac{4y_0^3}{3}-6y_0^2+12y_0+\frac{4}{y_0-1}-\frac{38}{3}\bigg)H(1,c_1(\alpha_0),0;y_0)+\bigg(\frac{2d_1'y_0^3}{3}-$$

$$3d_1'y_0^2+6d_1'y_0-\frac{19d_1'}{3}+\frac{2d_1'}{y_0-1}\bigg)H(1,c_1(\alpha_0),1;y_0)+\bigg(2y_0^3-9y_0^2+18y_0+4H(0;\alpha_0)+4d_1H(1;\alpha_0)+$$

$$\frac{4d_1}{y_0-1}-\frac{2d_1'}{y_0-1}+\frac{2}{y_0-1}-27\bigg)H(1,c_1(\alpha_0),c_1(\alpha_0);y_0)+\bigg(2\alpha_0d_1'-\frac{2d_1'}{y_0-1}-2d_1'\bigg)H(c_1(\alpha_0),1,c_1(\alpha_0);y_0)+$$

$$
\begin{aligned}
&\Big(4\,\alpha_0-\tfrac{4}{y_0-1}-4\Big)H(c_1(\alpha_0),c_1(\alpha_0),0;y_0)+\Big(2\alpha_0\,d_1'-\tfrac{2d_1'}{y_0-1}-2d_1'\Big)\,H(c_1(\alpha_0),c_1(\alpha_0),1;y_0)+\\
&\Big(6\alpha_0-\tfrac{6}{y_0-1}-6\Big)\,H(c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)+64H(0,0,0,0;y_0)+16d_1'\,H(0,0,0,1;y_0)-\\
&16H(0,0,0,c_1(\alpha_0);y_0)+(-8d_1+16d_1'+8)H(0,0,1,0;\,y_0)+4d_1'^2H(0,0,1,1;y_0)+(8d_1-4d_1'-\\
&8)H(0,0,1,c_1(\alpha_0);y_0)-8\,H(0,0,c_1(\alpha_0),0;y_0)-4d_1'H(0,0,c_1(\alpha_0),1;y_0)-\\
&4\,H(0,0,c_1(\alpha_0),c_1(\alpha_0);y_0)+(16d_1'+24)H(0,1,0,0;y_0)+\Big(4\,d_1'^2+4d_1'\Big)H(0,1,0,1;y_0)+(4d_1-\\
&4d_1'-8)\,H(0,1,0,c_1(\alpha_0);y_0)+\Big(4d_1'^2+8d_1'-12d_1\Big)\,H(0,1,1,0;y_0)+d_1'^3H(0,1,1,1;y_0)+(12d_1-\\
&8d_1')\,H(0,1,1,c_1(\alpha_0);y_0)-8H(0,1,c_1(\alpha_0),0;y_0)-4d_1'\,H(0,1,c_1(\alpha_0),1;y_0)+(-4d_1+2d_1'-\\
&8)\,H(0,1,c_1(\alpha_0),c_1(\alpha_0);y_0)+2d_1'H(0,c_1(\alpha_0),1,c_1(\alpha_0);y_0)+4\,H(0,c_1(\alpha_0),c_1(\alpha_0),0;y_0)+\\
&2d_1'H(0,c_1(\alpha_0),c_1(\alpha_0),1;y_0)+6\,H(0,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)-8H(1,0,0,c_1(\alpha_0);y_0)+(4-\\
&4d_1)\,H(1,0,1,0;y_0)+(4d_1-2d_1'-4)H(1,0,1,c_1(\alpha_0);y_0)-4\,H(1,0,c_1(\alpha_0),0;y_0)-\\
&2d_1'H(1,0,c_1(\alpha_0),1;y_0)+2\,H(1,0,c_1(\alpha_0),c_1(\alpha_0);y_0)+12H(1,1,0,0;y_0)+2d_1'\,H(1,1,0,1;y_0)+\\
&(4d_1-2d_1'-6)H(1,1,0,c_1(\alpha_0);y_0)+(-8d_1+4\,d_1'+2)H(1,1,1,0;y_0)+(8d_1-4d_1'-\\
&2)H(1,1,1,c_1(\alpha_0);y_0)-4\,H(1,1,c_1(\alpha_0),0;y_0)-2d_1'H(1,1,c_1(\alpha_0),1;y_0)+(-4d_1+2d_1'-\\
&2)\,H(1,1,c_1(\alpha_0),c_1(\alpha_0);y_0)+2d_1'H(1,c_1(\alpha_0),1,c_1(\alpha_0);y_0)+4\,H(1,c_1(\alpha_0),c_1(\alpha_0),0;y_0)+\\
&2d_1'H(1,c_1(\alpha_0),c_1(\alpha_0),1;y_0)+6\,H(1,c_1(\alpha_0),c_1(\alpha_0),c_1(\alpha_0);y_0)+H(1;y_0)\Big(\tfrac{1}{18}d_1'\,y_0^3\alpha_0^4-\tfrac{5}{12}d_1'y_0^2\alpha_0^4-\\
&\tfrac{47d_1'\,\alpha_0^4}{36}+\tfrac{5}{3}d_1'y_0\alpha_0^4-\tfrac{13}{54}d_1'y_0^3\alpha_0^3+\tfrac{17}{9}d_1'y_0^2\alpha_0^3+\tfrac{391d_1'\alpha_0^3}{54}-\tfrac{80}{9}\,d_1'y_0\alpha_0^3+\tfrac{11}{36}d_1'y_0^3\alpha_0^2-\tfrac{109}{36}d_1'\,y_0^2\alpha_0^2-\tfrac{89d_1'\alpha_0^2}{6}+\\
&\tfrac{158}{9}d_1'y_0\,\alpha_0^2+\tfrac{7}{18}d_1'y_0^3\alpha_0+\tfrac{7}{18}d_1'y_0^2\,\alpha_0+\tfrac{247d_1'\alpha_0}{18}-\tfrac{43d_1'y_0\alpha_0}{3}+\tfrac{251\,d_1'^3}{216}-\tfrac{d_1'^3y_0^3}{27}+\tfrac{11d_1'^2\,y_0^3}{27}-\tfrac{44d_1'y_0^3}{27}+\tfrac{1}{9}d_1'\pi^2\,y_0^3+\\
&\tfrac{\pi^2y_0^3}{9}-\tfrac{398d_1'^2}{27}+\tfrac{17d_1'^3\,y_0^2}{72}-\tfrac{25d_1'^2y_0^2}{9}+\tfrac{37d_1'\,y_0^2}{4}-\tfrac{1}{2}d_1'\pi^2y_0^2-\tfrac{\pi^2\,y_0^2}{2}+\tfrac{4361d_1'}{108}-\tfrac{49d_1'^3y_0}{36}+\tfrac{154\,d_1'^2y_0}{9}-48d_1'y_0+\\
&d_1'\pi^2y_0+\pi^2y_0+\Big(-\tfrac{17\,d_1'y_0^3}{18}-\tfrac{49y_0^3}{18}+\tfrac{4d_1y_0^2}{3}+\tfrac{19\,d_1'y_0^2}{6}+\tfrac{41y_0^2}{3}-\tfrac{16d_1y_0}{3}-\tfrac{11d_1'\,y_0}{6}-\tfrac{221y_0}{6}+\tfrac{37d_1}{18}-\tfrac{7\,d_1'}{18}-\\
&\tfrac{d_1}{3(y_0-1)}+\tfrac{d_1'}{6(y_0-1)}-\tfrac{37}{6\,(y_0-1)}-\tfrac{1}{(y_0-1)^2}+\tfrac{130}{3}\Big)H(0;\alpha_0)+\Big(\tfrac{4\,y_0^3}{3}-6y_0^2+12y_0+\tfrac{4}{y_0-1}-\tfrac{38}{3}\Big)\,H(0,0;\alpha_0)+\\
&\Big(\tfrac{4d_1y_0^3}{3}-6d_1y_0^2+12d_1y_0-\tfrac{38\,d_1}{3}+\tfrac{4d_1}{y_0-1}\Big)H(0,1;\alpha_0)+\tfrac{2d_1\pi^2}{3\,(y_0-1)}-\tfrac{d_1'\pi^2}{3(y_0-1)}-\tfrac{\pi^2}{3(y_0-1)}-6\,\zeta_3-\tfrac{11d_1'\pi^2}{18}-\\
&\tfrac{43\pi^2}{18}\Big)+H(0;y_0)\,\Big(\tfrac{y_0^3\alpha_0^4}{9}-\tfrac{5y_0^2\alpha_0^4}{6}+\tfrac{10y_0\,\alpha_0^4}{3}-\tfrac{13y_0^3\alpha_0^3}{27}+\tfrac{34y_0^2\,\alpha_0^3}{9}-\tfrac{160y_0\alpha_0^3}{9}+\tfrac{11y_0^3\alpha_0^2}{18}-\tfrac{109\,y_0^2\alpha_0^2}{18}+\tfrac{316y_0\alpha_0^2}{9}+\\
&\tfrac{7y_0^3\,\alpha_0}{9}+\tfrac{7y_0^2\alpha_0}{9}-\tfrac{86y_0\alpha_0}{3}-\tfrac{4d_1'^2\,y_0^3}{27}+\tfrac{205d_1y_0^3}{108}+\tfrac{35d_1'y_0^3}{18}+\tfrac{4\,\pi^2y_0^3}{9}-\tfrac{625y_0^3}{54}+\tfrac{17d_1'^2\,y_0^2}{18}-\tfrac{22d_1y_0^2}{3}-\tfrac{110d_1'y_0^2}{9}-2\pi^2\,y_0^2+\\
&\tfrac{520y_0^2}{9}-\tfrac{217d_1}{36}+\tfrac{d_1'}{6}-\tfrac{49\,d_1'^2y_0}{9}+\tfrac{469d_1y_0}{36}+\tfrac{1225d_1'y_0}{18}+4\pi^2y_0-\tfrac{2042y_0}{9}+\Big(-\tfrac{7y_0^3}{3}+\tfrac{26\,y_0^2}{3}-11y_0+\tfrac{13}{3(y_0-1)}+\\
&\tfrac{13}{3}\Big)\,H(0;\alpha_0)-\tfrac{217d_1}{36(y_0-1)}+\tfrac{d_1'}{6(y_0-1)}-\tfrac{4\,\pi^2}{3(y_0-1)}+\tfrac{88}{9(y_0-1)}+\tfrac{19}{12(y_0-1)^2}+6\,\zeta_3-\tfrac{4\pi^2}{3}+\tfrac{295}{36}\Big)-\tfrac{2d_1\pi^2}{3\,(y_0-1)}+\\
&\tfrac{d_1'\pi^2}{3(y_0-1)}+\tfrac{37\pi^2}{36\,(y_0-1)}+\tfrac{\pi^2}{6(y_0-1)^2}-4y_0^3\zeta_3+18y_0^2\,\zeta_3-36y_0\zeta_3+\tfrac{6\zeta_3}{y_0-1}+6\zeta_3-\tfrac{\pi^4}{120}-\tfrac{2d_1\pi^2}{3}+\tfrac{d_1'\pi^2}{3}+\tfrac{31\pi^2}{36}.
\end{aligned}
$$